

White Sands Missile Range
(WSMR, Utah Launch Complex)

HAER No. NM-1

White Sands Missile Range
Dona Anna, Sierra, Socorro, & Lincoln Counties
New Mexico

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

White Sands Missile Range

NM-1

Location: In Southern New Mexico in Dona Ana, Sierra, Socorro and Lincoln Counties.

Date of Construction: Established in 1945.

Owner: Department of the Army

Significance: The largest and most highly instrumented range of its kind, White Sands Missile Range supports missile development and test programs for the Army, Navy, Air Force, NASA and other organizations. Prior to its establishment in 1945, White Sands, Missile Range was the site of the detonation of the first atomic device. The installation also played an important role in early missile development with the testing of captured German V-2 rockets and later American-made rockets.

Historical Report
Prepared by: David G. Buchanan, John P. Johnson and William A. Brenner, 1984.

Prepared for
Transmittal by: Robie S. Lange, HABS/HAER, 1985.

EXECUTIVE SUMMARY

White Sands Missile Range, located in southern New Mexico, is the largest and most highly instrumented range of its kind. It supports missile development and test programs for the Army, Navy, Air Force, the National Aeronautics and Space Administration, and other organizations. Established in 1945, the main range, excluding extension areas, covers nearly 4,000 square miles and includes the 230 square mile White Sands National Monument. The Utah Launch Complex in Green River, Utah, is a subinstallation to White Sands that is now inactive. Both the missile range and the launch complex are under the operational control of the U.S. Army Test and Evaluation Command.

The world's first atomic bomb was detonated on the northern part of the range on July 16, 1945. The location of the blast, Trinity Site, is a National Historic Landmark. The American V-2 rocket program began at White Sands less than a year later, and a total of 67 V-2 rockets were tested between 1946 and 1951 at Launch Complex 33, thereby initiating America's space program.

Category I historic properties at White Sands are Trinity Site (including Ground Zero, Jumbo, six camera and instrumentation bunkers, the George McDonald ranch house, and Base Camp) and Launch Complex 33 (the Army blockhouse and V-2 gantry crane). Category II historic properties are the Holloman Test Track, located on the Holloman Air Force Base Supplemental Area adjacent to White Sands, and the 100,000 and 500,000 pound Static Test Stands. The Holloman track and the two static test stands are both closely

associated with early rocket and space-related research. Category III historic properties are the V-2 Assembly Building (Building 1538), Launch Complex 35 (the Navy blockhouse, launch towers, and U.S.S. Desert Ship), the Estey City Mining Ruins, the Eugene Manlove Rhodes Grave Site, the Hardin Ranch, and the Propulsion Unit Calibration Stand Blockhouse.

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PREFACE

This report presents the results of an historic properties survey of White Sands Missile Range, New Mexico, and subinstallation Utah Launch Complex, Green River, Utah. Prepared for the United States Army Materiel Development and Readiness Command (DARCOM), the report is intended to assist the Army in bringing these installations into compliance with the National Historic Preservation Act of 1966 and its amendments, and related federal laws and regulations. To this end, the report focuses on the identification, evaluation, documentation, nomination, and preservation of historic properties at the two installations. Chapter 1 sets forth the survey's scope and methodology; Chapter 2 presents an architectural, historical, and technological overview of the installations and their properties; and Chapter 3 identifies significant properties by Army category and sets forth preservation recommendations. Illustrations and an annotated bibliography supplement the text.

This report is part of a program initiated through a memorandum of agreement between the National Park Service, Department of the Interior, and the U.S. Department of the Army. The program covers 74 DARCOM installations and has two components: 1) a survey of historic properties (districts, buildings, structures, and objects), and 2) the development of archeological overviews. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, directed the program for the Army, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) directed the program for the National Park Service. Sally

Kress Tompkins was program manager, and Robie S. Lange was project manager for the historic properties survey. Technical assistance was provided by Donald C. Jackson.

Building Technology Incorporated acted as primary contractor to HABS/HAER for the historic properties survey. William A. Brenner was BTI's principal-in-charge and Dr. Larry D. Lankton was the chief technical consultant. Major subcontractors were the MacDonald and Mack Partnership and Melvyn Green and Associates. The authors of this report were David G. Buchanan, John P. Johnson, and William A. Brenner. The authors gratefully acknowledge Environmental Officer Albert Johnson and Range Inspector James T. Emanuel of White Sands Missile Range for their invaluable help during the course of the survey.

The complete HABS/HAER documentation for these installations will be included in the HABS/HAER collections at the Library of Congress, Prints and Photographs Division, under the designation HAER NO. NM-1.

Chapter 1

INTRODUCTION

SCOPE

This report is based on an historic properties survey conducted in 1983 of all Army-owned properties located within the official boundaries of White Sands Missile Range and the Utah Launch Complex. The survey included the following tasks:

- Completion of documentary research on the history of the installations and their properties, and general research on the history of rocketry.
- Completion of a field inventory of properties at the installations.
- Preparation of an architectural, historical, and technological overview for the installations.
- Evaluation of historic properties and development of recommendations for preservation of these properties.

Also completed as a part of the historic properties survey of the installations, but not included in this report, are HABS/HAER Inventory cards for 102 individual properties. These cards, which constitute HABS/HAER Documentation Level IV, will be provided to the Department of the Army. Archival copies of the cards, with their accompanying photographic negatives, will be transmitted to the HABS/HAER collections at the Library of Congress.

The methodology used to complete these tasks is described in the following section of this report.

METHODOLOGY

1. Documentary Research

White Sands Missile Range, established in 1945 by the Ordnance Department of the U.S. Army as a land range for testing rockets and missiles, is an important site in the history of modern military technology. Documentary research for this report focused on the rocketry programs associated with White Sands and on the developmental history of the installation itself. Published documentary sources were obtained at the Library of Congress in Washington, D.C., the local history archives of the New Mexico State University at Las Cruces, and at White Sands Missile Range. Unpublished sources were obtained from the historical files of the Public Affairs Office of White Sands Missile Range. The Public Affairs Officer, William Gross, provided complete access to the historic photographic files, which yielded interesting and helpful material. White Sands personnel also provided a variety of documents related to Trinity Site, including the 1972 National Register of Historic Places nomination for the site. The New Mexico State Historic Preservation Office in Sante Fe provided a copy of a state-wide engineering inventory conducted in 1977 by Texas Technological University at Lubbock, and a copy of the state register form for Launch Complex 33 (New Mexico State Register of Cultural Properties, Property Number 580).

Army records used for the field inventory included current Real Property Inventory (RPI) printouts that listed all officially recorded buildings and structures by facility classification and date of construction; the

installations' property record cards; base maps and photographs; and installation master planning, archeological, and environmental assessment and related reports and documents. Much of this information was provided by Robert Mitchell and Jean Simpson of the Master Planning Branch of the Facilities Engineer. A complete listing of documentary material may be found in the bibliography.

Special research was conducted to determine the location and condition of pre-military ranching and mining sites prior to actual field work. Initial documentation was obtained from road maps and existing real estate records. Range Inspectors James T. Emanuel and Thomas Dayberry supplemented this information with their extensive knowledge of the range area. U.S.G.S. maps (15-minute series), Army Mapping Service Quadrants (1:50,000), and a 1937 highway map of Socorro County were consulted and cross-referenced to provide the most accurate record possible of ranch and mining sites within the boundaries of White Sands. Research assistance and advice was also provided by Tom Merlan, New Mexico State Historic Preservation Officer, Santa Fe; Patrick Beckett of COAS Publishing and Research, Las Cruces; and Peter Eidenbach of Human Systems Research, Inc., Tularosa, New Mexico.

2. Field Inventory

The field inventory of military properties at White Sands Missile Range was conducted in February, 1983, by William A. Brenner, David G. Buchanan, and John P. Johnson. The White Sands Environmental Officer, Albert Johnson, coordinated the inventory process and provided assistance with security procedures.

Field inventory procedures were based on the HABS/HAER Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures.¹ HABS/HAER Inventory cards were prepared for, and black and white 35 mm photographs taken of, all buildings and structures through 1945 and for representative post-1945 buildings and structures,² as follows:

- a) All buildings in the main post area were surveyed to confirm existing real property records. The V-2 assembly building (1945) and post-war representative building types were inventoried.
- b) The South Range Launch Complex (Launch Complexes 32-38 and 50) was surveyed and representative types of major launch facilities were inventoried. A particular focus of this phase of the survey was Launch Complex 33, including the Army blockhouse (1945) and the Gantry Crane (1946). The blockhouse interior was examined to learn more about its function, construction, and present condition and use.
- c) The static test sites were surveyed and the three major test stands were inventoried. An interior survey was made of the 500K Static Test Facility, although certain parts of the structure, including the underground control room, were inaccessible.
- d) All buildings in the main area of the Small Missile Range were surveyed, and representative structures were inventoried.

- e) A representative sample of the approximately 1,000 instrumentation sites scattered throughout the 4,000 square mile area of White Sands were inventoried.
- f) The Stallion, Rhodes Canyon, Oscura, and North Oscura Range Centers are located 60 to 100 miles up-range from the main post area. Real property records for and detailed aerial photographs of buildings in these areas were closely examined. Because the range centers were constructed after 1945 and their buildings are all of very simple wood and cinder block construction (and are similar to many buildings on the main post area), only the Stallion, Rhodes Canyon, and North Oscura Range Centers were visited, and no buildings were inventoried at these sites.

Following the survey of military properties, Trinity Site and all known pre-military ranching and mining properties on the missile range were inventoried by William A. Brenner and David G. Buchanan. This inventory, conducted by 4-wheel drive vehicle and helicopter, was led by Range Inspector James T. Emanuel. Approximately 60 ranch and mining sites with extant structures were recorded and photographed during the February, 1983 survey, and about 20 additional sites were photographed by Range Inspector Emanuel in May, 1983.

The rocket test track at the Holloman Air Force Base Supplemental Area was inventoried by William A. Brenner and David G. Buchanan. Leon Washiewicz and Lt. Col. Charles Norwood provided a briefing and tour of the test facility, which is operated by Holloman Air Force Base.

In March, 1983, a field inventory of the Utah Launch Complex at Green River, Utah, was conducted by David G. Buchanan and John P. Johnson. Sgt. Maj. L. Sexton assisted the survey team.

3. Historic Overview

A combined architectural, historical, and technological overview was prepared from information developed from the documentary research and the field inventory. It was written in two parts: 1) an introductory description of the installation, and 2) a history of the installation by periods of development, beginning with pre-military land uses. Maps and photographs were selected to supplement the text as appropriate.

The objectives of the overview were to 1) establish the periods of major construction at the installation, 2) identify important events and individuals associated with specific historic properties, 3) describe patterns and locations of historic property types, and 4) analyze specific building and industrial technologies employed at the installation.

4. Property Evaluation and Preservation Measures

Based on information developed in the historical overviews, properties were first evaluated for historical significance in accordance with the eligibility criteria for nomination to the National Register of Historic Places. These criteria require that eligible properties possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that they meet one or more of the following:³

- A. Are associated with events that have made a significant contribution to the broad patterns of our history.
- B. Are associated with the lives of persons significant in the nation's past.
- C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.
- D. Have yielded, or may be likely to yield, information important in pre-history or history.

Properties thus evaluated were further assessed for placement in one of five Army historic property categories as described in Army Regulation 420-40:⁴

Category I	Properties of major importance
Category II	Properties of importance
Category III	Properties of minor importance
Category IV	Properties of little or no importance
Category V	Properties detrimental to the significance of of adjacent historic properties

Based on an extensive review of the architectural, historical, and technological resources identified on DARCOM installations nationwide, four criteria were developed to help determine the appropriate categorization level for each Army property. These criteria were used to assess the

importance not only of properties of traditional historical interest, but of the vast number of standardized or prototypical buildings, structures, and production processes that were built and put into service during World War II, as well as of properties associated with many post-war technological achievements. The four criteria were often used in combination and are as follows:

- 1) Degree of importance as a work of architectural, engineering, or industrial design. This criterion took into account the qualitative factors by which design is normally judged: artistic merit, workmanship, appropriate use of materials, and functionality.
- 2) Degree of rarity as a remaining example of a once widely used architectural, engineering, or industrial design or process. This criterion was applied primarily to the many standardized or prototypical DARCOM buildings, structures, or industrial processes. The more widespread or influential the design or process, the greater the importance of the remaining examples of the design or process was considered to be. This criterion was also used for non-military structures such as farmhouses and other once prevalent building types.
- 3) Degree of integrity or completeness. This criterion compared the current condition, appearance, and function of a building, structure, architectural assemblage, or industrial process to its original or most historically important condition, appearance, and function. Those properties that were highly intact were generally considered of greater importance than those that were not.

4) Degree of association with an important person, program, or event.

This criterion was used to examine the relationship of a property to a famous personage, wartime project, or similar factor that lent the property special importance.

The majority of DARCOM properties were built just prior to or during World War II, and special attention was given to their evaluation. Those that still remain do not often possess individual importance, but collectively they represent the remnants of a vast construction undertaking whose architectural, historical, and technological importance needed to be assessed before their numbers diminished further. This assessment centered on an extensive review of the military construction of the 1940-1945 period, and its contribution to the history of World War II and the post-war Army landscape.

Because technology has advanced so rapidly since the war, post-World War II properties were also given attention. These properties were evaluated in terms of the nation's more recent accomplishments in weaponry, rocketry, electronics, and related technological and scientific endeavors. Thus the traditional definition of "historic" as a property 50 or more years old was not germane in the assessment of either World War II or post-war DARCOM buildings and structures; rather, the historic importance of all properties was evaluated as completely as possible regardless of age.

Property designations by category are expected to be useful for approximately ten years, after which all categorizations should be reviewed and updated.

Following this categorization procedure, Category I, II, and III historic properties were analyzed in terms of:

- Current structural condition and state of repair. This information was taken from the field inventory forms and photographs, and was often supplemented by rechecking with facilities engineering personnel.
- The nature of possible future adverse impacts to the property. This information was gathered from the installation's master planning documents and rechecked with facilities engineering personnel.

Based on the above considerations, the general preservation recommendations presented in Chapter 3 for Category I, II, and III historic properties were developed. Special preservation recommendations were created for individual properties as circumstances required.

5. Report Review

Prior to being completed in final form, this report was subjected to an in-house review by Building Technology Incorporated. It was then sent in draft to the subject installation for comment and clearance and, with its associated historical materials, to HABS/HAER staff for technical review. When the installation cleared the report, additional draft copies

were sent to DARCOM, the appropriate State Historic Preservation Officer, and, when requested, to the archeological contractor performing parallel work at the installation. The report was revised based on all comments collected, then published in final form.

NOTES

1. Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures (unpublished draft, 1982).
2. Representative post-World War II buildings and structures were defined as properties that were: (a) "representative" by virtue of construction type, architectural type, function, or a combination of these, (b) of obvious Category I, II, or III historic importance, or (c) prominent on the installation by virtue of size, location, or other distinctive feature.
3. National Park Service, How to Complete National Register Forms (Washington, D.C.: U.S. Government Printing Office, January 1977).
4. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).

Chapter 2

HISTORICAL OVERVIEW

BACKGROUND

White Sands Missile Range, located in southern New Mexico, is the largest all-over-land military reservation in the United States. The main range, excluding extension areas, covers nearly 4,000 square miles and includes the 230 square mile White Sands National Monument. Established February 20, 1945, and formally commissioned on July 13, 1945, as White Sands Proving Ground, the name of the reservation was changed to White Sands Missile Range in 1958. White Sands supports missile development and test programs for the Army, Navy, and Air Force, the National Aeronautics and Space Administration (NASA), and other government agencies. It is under the operational control of the U.S. Army Test and Evaluation Command (TECOM), a major subordinate command of DARCOM. The world's first atomic bomb was detonated on the northern portion of the range on July 16, 1945. The location of the blast, Trinity Site, is a National Historic Landmark.

(Illustrations 1 and 2)

The history of White Sands dates to World War II and the beginning of the Army's rocket testing program. In June, 1944, the Army Ordnance Department (ORD) awarded a contract for the research and development of long-range surface-to-surface rockets to the California Institute of Technology (CIT). The program, known as ORDCIT, conducted basic research applicable to guided missiles. The first phase of the ORDCIT program developed the



ILLUSTRATION 1 White Sands Missile Range Boundaries. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

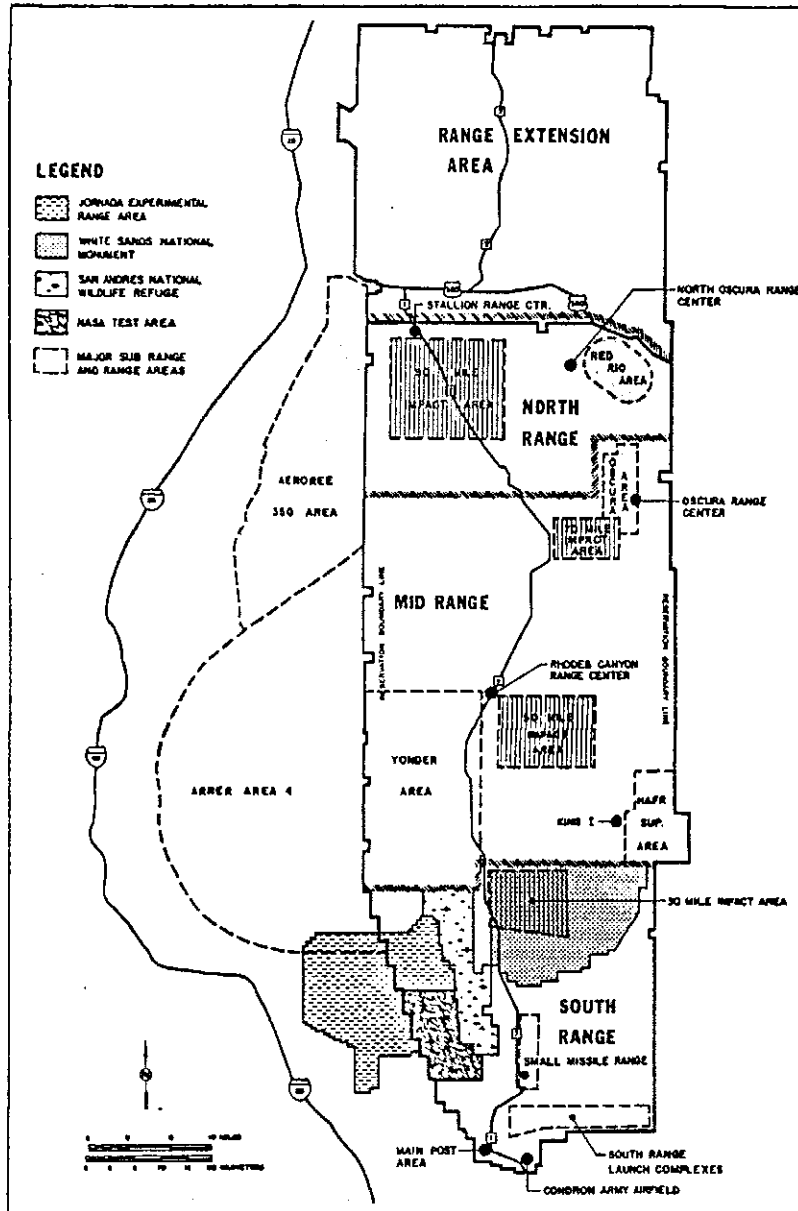


ILLUSTRATION 2 General base map with major land use areas indicated.
Source: White Sands Missile Range, Installation Environmental Impact Statement.

Private-A and Private-F solid propellant rockets. These were tested at Camp Irwin, California, and Fort Bliss, Texas, between December, 1944, and April, 1945.¹ The second phase of the ORDCIT program was the design and construction of the WAC Corporal, a 2,000 pound rocket powered by a liquid propellant motor capable of carrying 25 pounds of meteorological instruments to an altitude of 100,000 feet.²

Anticipating a greatly expanded rocket program, the Army established a new proving ground near White Sands, New Mexico, in early 1945 as a test firing range for rockets and guided missiles. Concurrently preparations began in the northern part of the range for the Trinity atomic bomb test, which took place on July 16. In September, a modified Tiny Tim was the first rocket tested at the new proving ground. Although originally designed as a naval rocket to be used in forward firing from aircraft against ships, Tiny Tim was tested as a jet-assisted take-off (JATO) or booster engine for the WAC Corporal missile.³

The third phase of the ORDCIT program was the Corporal-E missile, fired at White Sands in May, 1947. This was the first ORDCIT test vehicle incorporating command guidance and the first completely American designed, engineered, and fabricated surface-to-surface missile. Tests on the Corporal-E were conducted between 1947 and 1951.⁴

Concurrent with the early ORDCIT testing, White Sands began its V-2 rocket program. After the Allies captured German rocket bases, 300 boxcars of V-2 components were salvaged from factories, railyards, and airfields and shipped to the United States. When German scientists of the famed A-4 Division of

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the Peenemunde Rocket Base surrendered to the Allies in April, 1945, twenty of the most knowledgeable, including Werner Von Braun, were assigned to White Sands to aid in the development of an American rocket program based on the V-2. At White Sands, V-2 rockets were assembled from the salvaged German parts, and a static test stand, designed in part by the German scientists, was constructed to permit firing of the V-2 engine under full power conditions. The successful firing made on this test stand in March, 1946, led to a flight test in April of that year. Between 1946 and 1951, a total of 67 V-2 rockets were assembled and tested at the proving ground.⁵

Since that time, more than 30,000 rockets and missiles have been tested at White Sands, including the Army's Aerobee, Honest John, Redstone, Nike Ajax, Nike Hercules, Pershing, Patriot, and Roland missiles, as well as numerous Air Force and Navy missiles.⁶

In 1956, an off-range firing program was initiated with the launching of a Rascal missile from near Orogrande, New Mexico, to an impact zone at White Sands. Beginning in 1963, Air Force Athena missiles, and later Army Pershing missiles, were launched from the Utah Launch Complex at Green River, Utah, to impact on White Sands, about 450 miles away.⁷

White Sands Missile Range currently has the technical facilities for test firing a great variety of long-range rockets and guided missiles. It is equipped with numerous launch complexes and a network of optical and electronic instrument buildings to collect a variety of test data. Computer systems process and correlate test information to provide highly reliable

records of missile performance. Special facilities, including nuclear environments, weapons systems simulation labs, and guidance and climate control laboratories provide additional test capabilities.

White Sands is divided into various directorates and administrative support offices. Among the major directorates are the National Range Operations (NRO), the Army Missile Test and Evaluation (ARMTE), and the Instrumentation Directorate (ID). Several tenant organizations use the White Sands facilities, including the Naval Ordnance Missile Test Facility (NOMTF), the Atmospheric Sciences Laboratory (ASL), and the National Aeronautics and Space Administration (NASA).

The Naval Ordnance Missile Test Facility is the land-based arm of the Navy's missile program. The Navy was involved with the Army in the V-2 rocket program, but since 1946 has concentrated on its own missile programs. Among the Navy missiles tested at White Sands are the Viking and Aerobee upper atmospheric research rockets and a variety of surface-to-air missiles.⁸

The Atmospheric Sciences Laboratory, now part of the Army Electronics Research and Development Command (ERADCOM), was begun at White Sands in 1946. Then a part of the Army Signal Corps, it provided radar and communications support for the early V-2 rocket program. Today, the Atmospheric Sciences Laboratory conducts meteorological research, with particular emphasis on atmospheric research and remote sensing techniques.⁹

The Holloman Test Track, an aerospace ground test facility used to simulate flight conditions in a closely controlled environment, is located in the Holloman Air Force Supplemental Area adjacent to White Sands. The 50,788 foot high-speed track is operated by the Air Force and is closely tied to test activities at the missile range.

NASA operates its White Sands Test Facility (not included in this report) on an 88 square mile outgrant on the western boundary of White Sands Missile Range, and since 1963 has conducted extensive testing for the Apollo rocket program, the Skylab program, and most recently for the Space Shuttle. On March 30, 1982, Space Shuttle Columbia ended its third mission by landing at the Northrup Air Strip located near the center of the White Sands Missile Range.¹⁰

The White Sands National Monument is located within the eastern portion of the White Sands Missile Range. Managed by the National Park Service, Department of Interior, the monument is the world's largest inland outcropping of pure gypsum, composed of approximately 176,000 acres of white gypsum "sand" that shifts continually from one high dune to another. The area became a national park in 1933, and its white sands inspired the name for the missile range. Through a special use permit and agreement with the National Park Service, missile flights over the monument are permitted, and some missile impacts in the northwest corner of the monument are allowed. The area contains no structures except minor service buildings maintained and operated by the National Park Service.¹¹

PRE-MILITARY LAND USE

White Sands Missile Range covers a substantial part of the Tularosa Basin in south-central New Mexico, where Indian cultures pre-dominated until the arrival of Spanish soldiers, missionaries, and traders from Mexico in the late 16th century. Permanent white settlement began in the early 19th century under land grants from the Mexican government. The Butterfield and Chisholm Trails brought English-speaking settlers into the region prior to the Civil War, but most permanent settlement took place after about 1880.

The land now within the missile range was used predominantly for ranching, and to some extent mining, before its acquisition by the Army. Remnants of both activities are scattered throughout much of the range, particularly in the San Andres and Oscura Mountains, and the plains above Mockingbird Gap.

Signs of mining activity are most prevalent on the eastern slope of San Augustin Peak and around Mineral Hill, both situated in the southwest corner of the range just above U.S. Route 70. There are many exposed mine openings in the area, and remnants include a variety of small mining shacks and related equipment, such as timbers, wire cables, piping, and the like. These mines produced copper, lead, silver, some gold, and a small amount of zinc, but were largely abandoned by the late 1930s.¹² (Illustrations 3, 4 and 5)

A smaller number of mines and prospecting sites occur several miles northeast of Mineral Hill on the eastern slopes of Black and Goat Mountains in the lower San Andres. Few signs of mining activity exist in the middle of the range, but a fairly large cluster of mines and prospecting sites are found at the San Andres' northern tip near Capitol Peak and Mockingbird Gap.

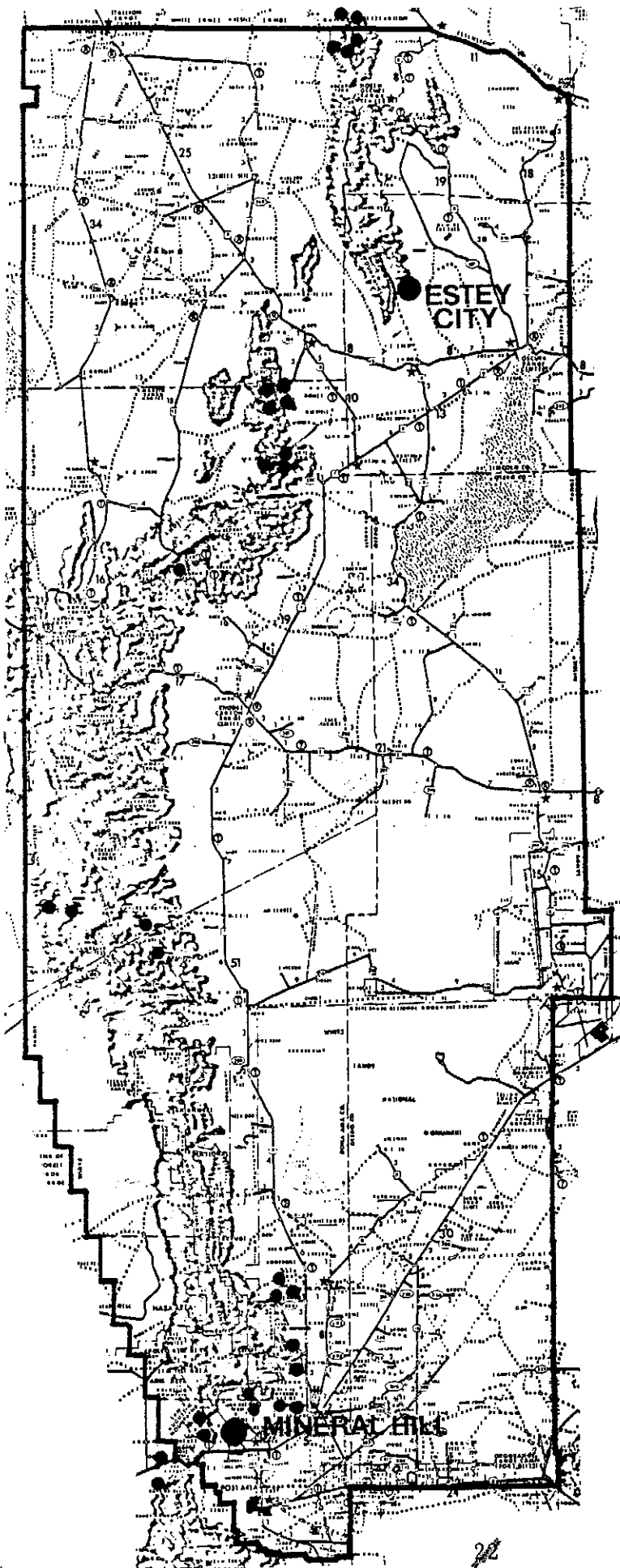


ILLUSTRATION 3

Principal location of mines and prospects. With the exception of the Mineral Hill and Estev City areas, few mining-associated structures remain. Source: USGS 1:250,000 series, Las Cruces and Tularosa, New Mexico, 1955.

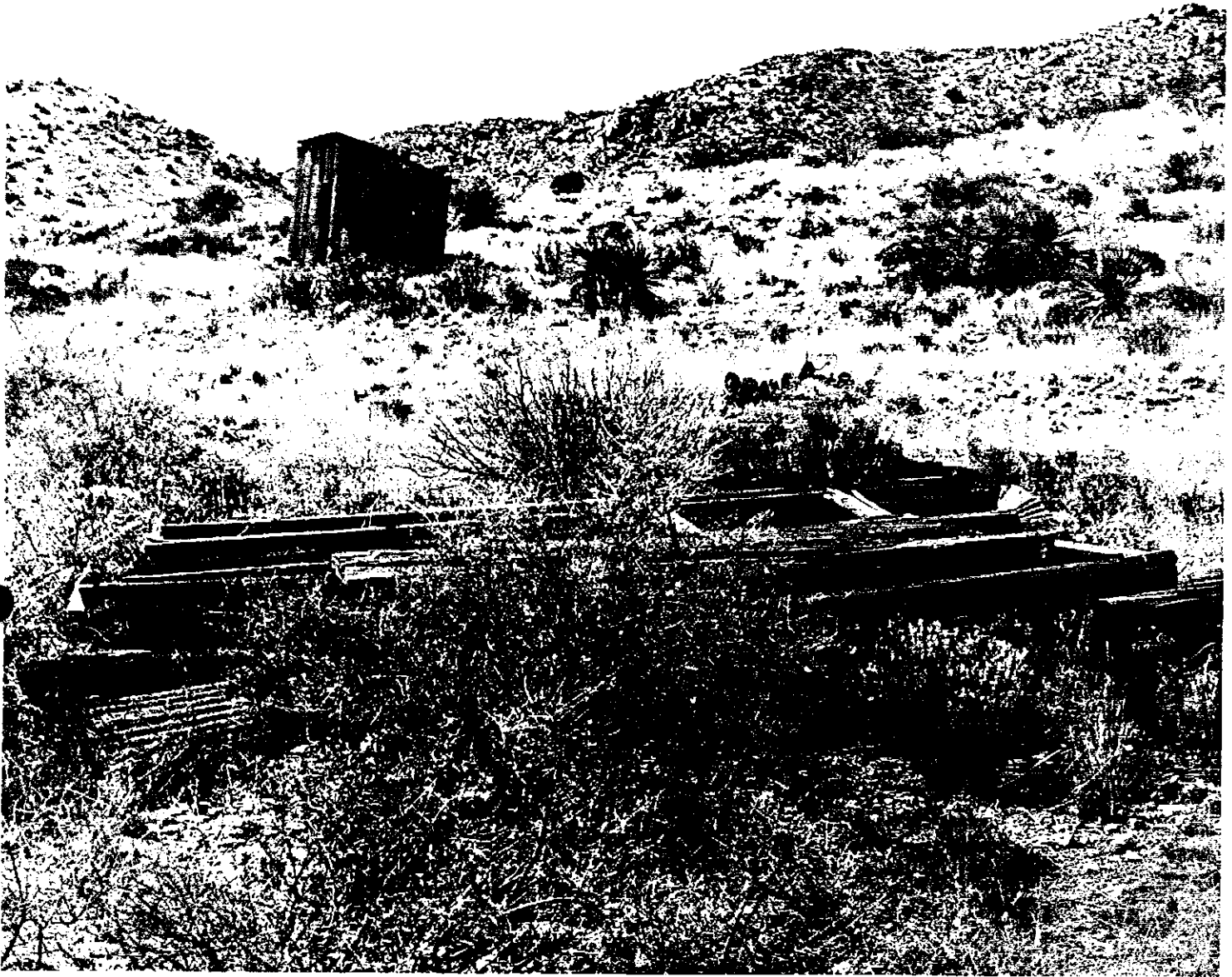


ILLUSTRATION 4 Mineral Hill mining ruins. The Mineral Hill mining district was heavily prospected and mined from about 1880 to the 1920's, although prospecting for gold continued through the 1930's. The mines mainly produced copper, lead, and silver, some gold, and a small amount of zinc. Source: Field inventory photograph, 1983, William A. Brenner, Building Technology, Inc.

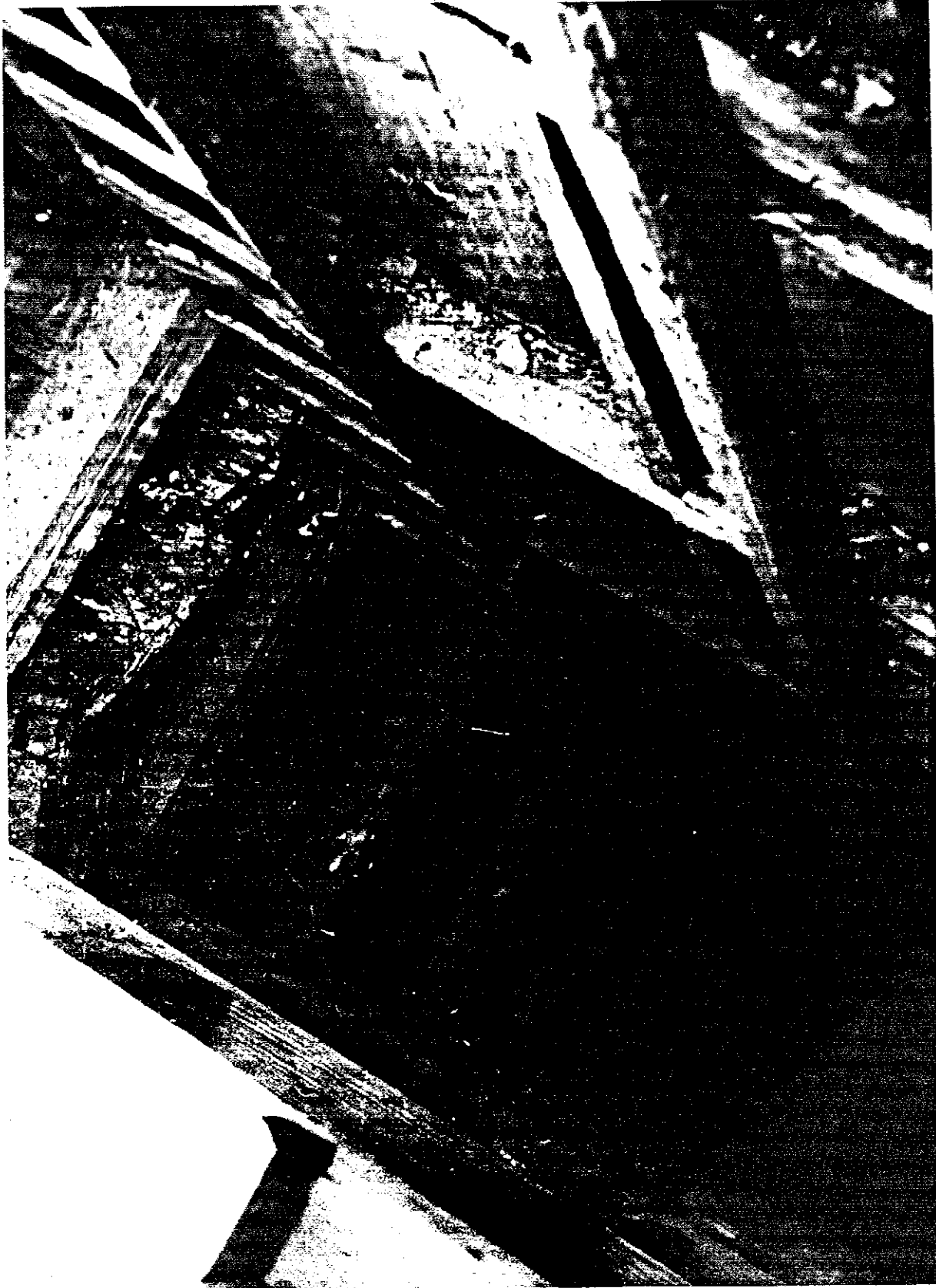


ILLUSTRATION 5 Open vertical mine shaft, Mineral Hill mining district.
Source: Field inventory photograph, 1983, William A.
Brenner, Building Technology, Inc.

The most fully developed mining site at White Sands is at Estey City, a cluster of stone ruins on the eastern slope of the lower Oscuras. Estey City was a small copper mining boom town from 1901 to 1931 (according to postal records) that was owned and operated by the Dividend Mining and Milling Company. The only recognizable remains of Estey City are the stone remnants of the company store and post office, and a depressed concrete reservoir.¹³ (Illustration 6)

Several mining sites are clustered at the northern end of the Oscura Mountains near the border of the missile range, and minor prospecting sites (often only a hole in the ground adjacent to a small mound of dirt) can be found at scattered sites throughout the range, on the plains as well as in the mountains. Few contain associated structures or equipment.

Ranching activity concentrated primarily in the middle and upper San Andres Mountains and on the eastern side of the Oscuras, with a moderate amount of activity in the lower San Andres and on the plains, particularly above Mockingbird Gap. The few ranches east of the San Andres were for the most part located near the mountains' base. Ranching centered on sheep and cattle raising, and the availability of potable water and suitable grazing land were primary locational determinants.¹⁴ (Illustration 7)

Buildings and structures associated with the ranches are mostly of simple design and construction and have little stylistic ornamentation. Early houses are made of adobe, logs, or stone, and later structures are more usually constructed of board and batten or, occasionally, frame construction. Out-buildings may be made of all of these materials, but are often simple pole

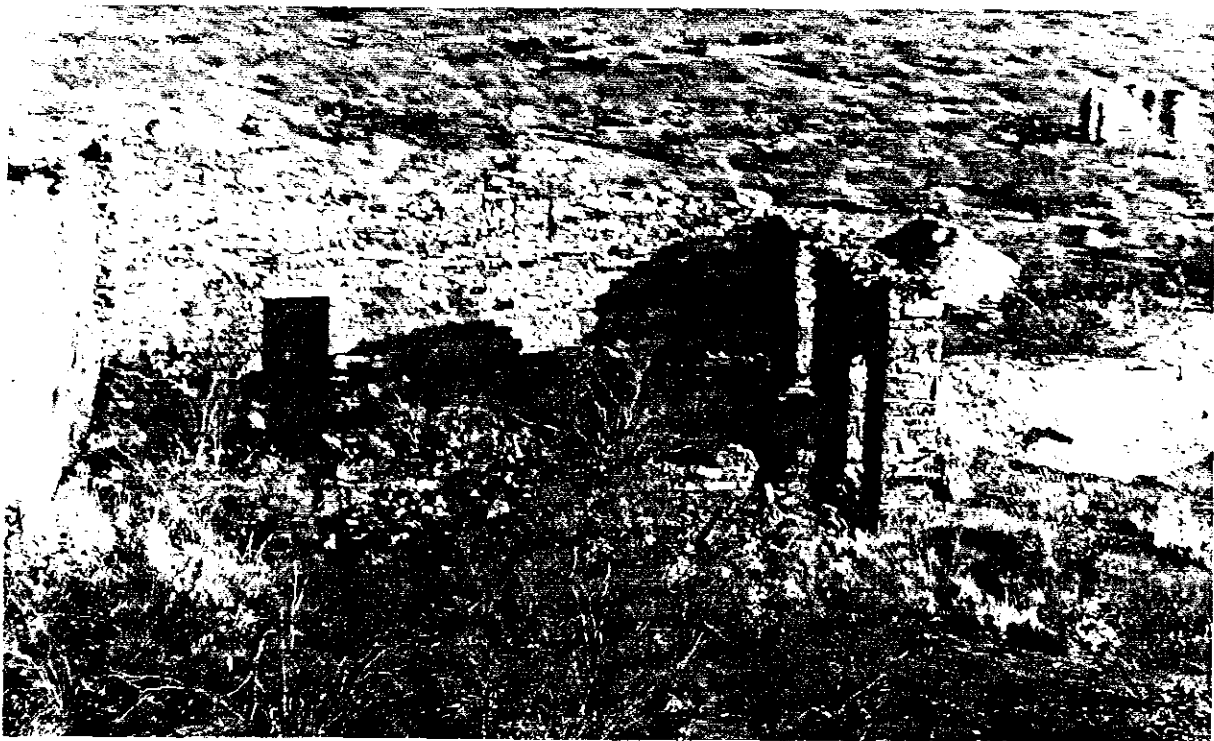


ILLUSTRATION 6 Estey City ruins. Built by the Dividend Mining and Milling Company, Estey City was an active copper mining complex for the first third of this century. Top view is of general store remains from the northeast. Bottom view is of general store from southwest, with post office ruin in the distance. Source: Field inventory photograph, 1983, William A. Brenner, Building Technology, Inc.

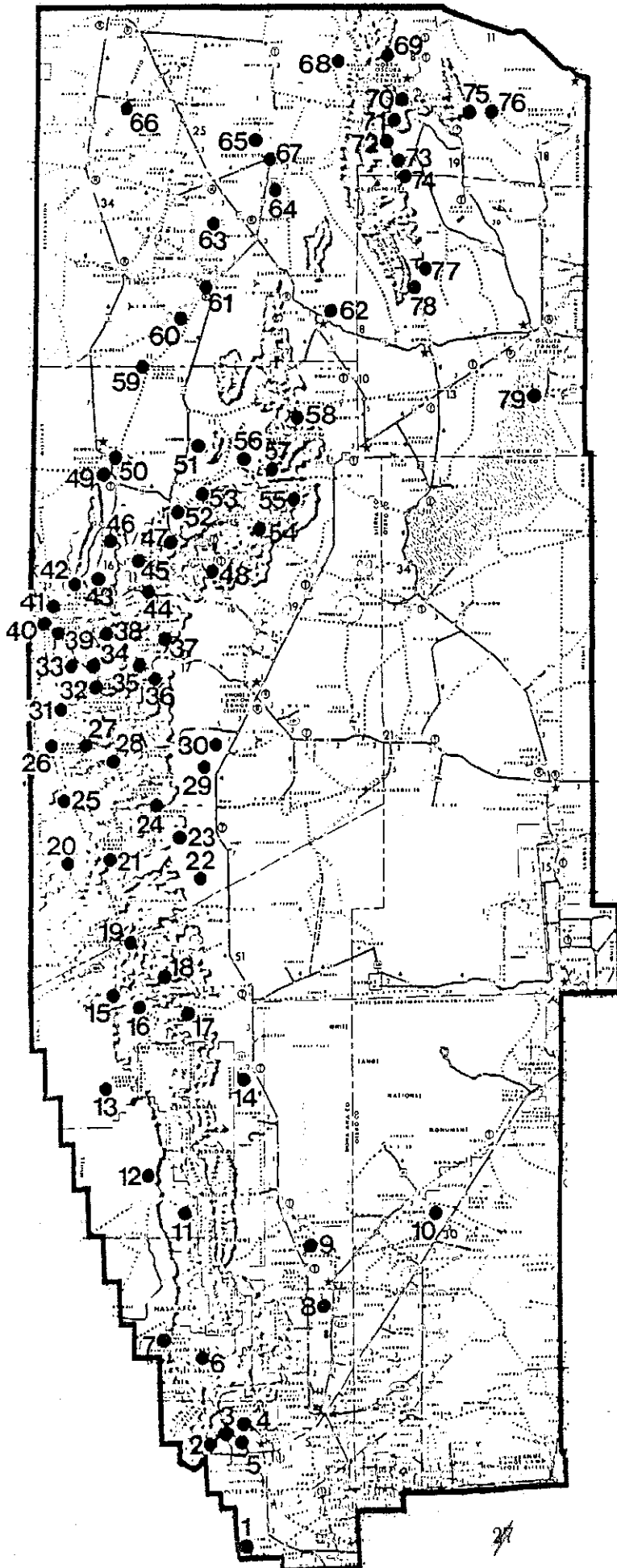


ILLUSTRATION 7

Location map of pre-military buildings and structures at White Sands Missile Range. Map also indicates major sites associated with the Trinity atomic bomb project. Source: Building Technology, Inc., 1983, based on field survey led by Range Inspector James T. Emanuel.

buildings covered with corrugated metal. The roofs of most houses and outbuildings are of corrugated metal over pole or frame joists; on adobe and stone houses they sometimes cover earlier flat roofs made of dirt, sod, or adobe laid over boards or timbers. Without exception, all ranch structures, including houses, are one story in height. They rarely have basements or cellars, and attics (when found) are low and unuseable. (Illustration 8)

Stone buildings at White Sands are mostly constructed of unfaced stone laid up with either adobe or cement mortar. A few have faced stone, and some are laid up without mortar. The stone structures are, as a group, the best preserved on the range. (Illustration 9)

Board and batten buildings are more recent. They do not have interior wall framing and are joined at the top with a small horizontal member that ties the wall together and, on the bearing walls, supports the ceiling and roof joists. Board and batten walls may have a double thickness of boards, but often the vertical siding acts as both the interior and exterior wall. The board and batten structures are the most common at White Sands and vary from good to poor condition. (Illustration 10)

There are fewer log structures, but a surprising number for an area so lacking in trees. Most appear quite old, and range from fair to poor condition. All are of conventional log design. (Illustration 11)

Structures at White Sands built of adobe brick and mortar were usually (but not always) covered with adobe stucco. Adobes vary in condition largely according to the soundness of their roofs. Those that had uncovered sod,



ILLUSTRATION 8

Early flat roof structures. Above, Moya house in Upper Oskuras with sod roof over wood timbers. Left, stone house at Ropes Spring has dirt roof that was later covered by a pitched metal roof, a common alteration to houses in the range. Source: Field inventory photograph, 1983, William A. Brenner, Building Technology, Inc.

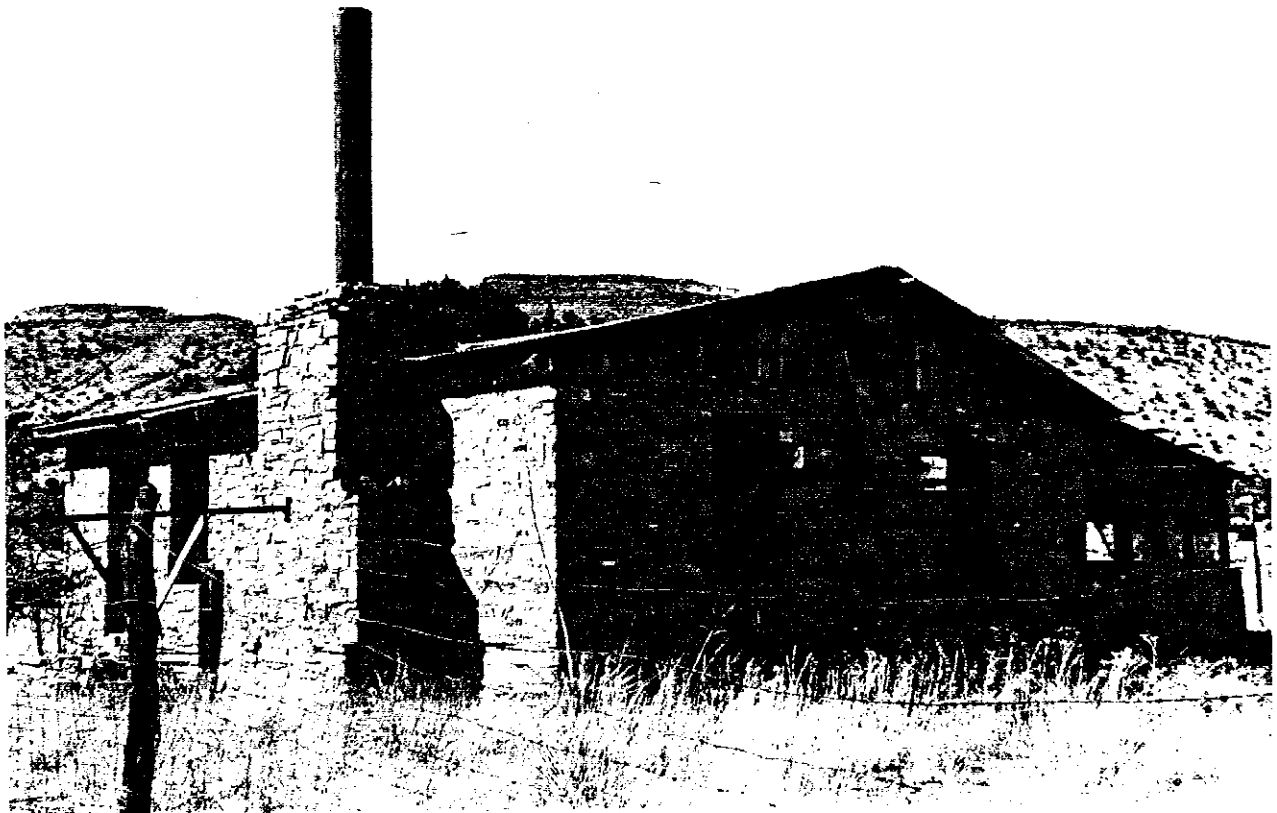
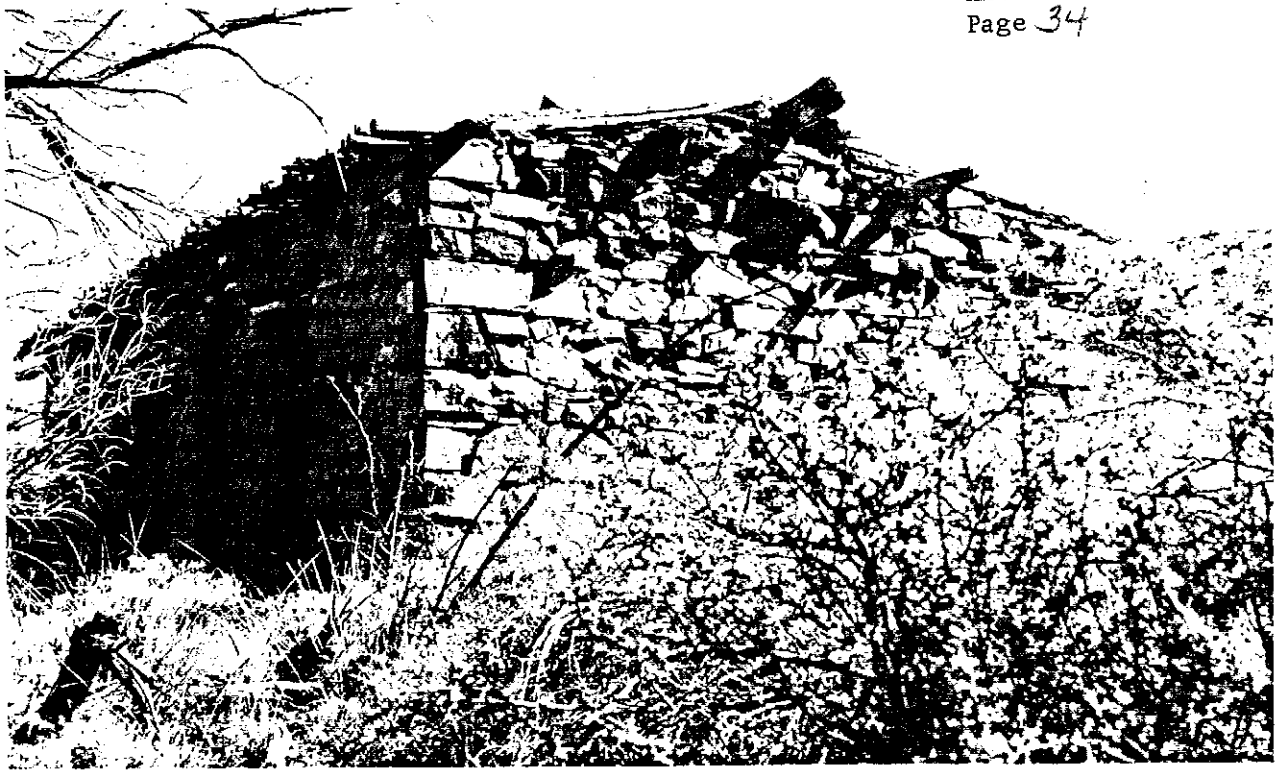


ILLUSTRATION 9

Stone houses. Top view is of the house at Rock House Spring, built of stone laid up without mortar. The early house, which may have been the home of Pat Garrett's family, has a rubble roof supported by a rough timber structure. Bottom view is of the Pete Wood house at northern end of Bear Den Canyon. It is a later structure that uses concrete mortar. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.



ILLUSTRATION 10 Board and batten house. This structure, the principal house at the Potter Ranch in Rhodes Canyon, is typical of the great number of board and batten houses at White Sands. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

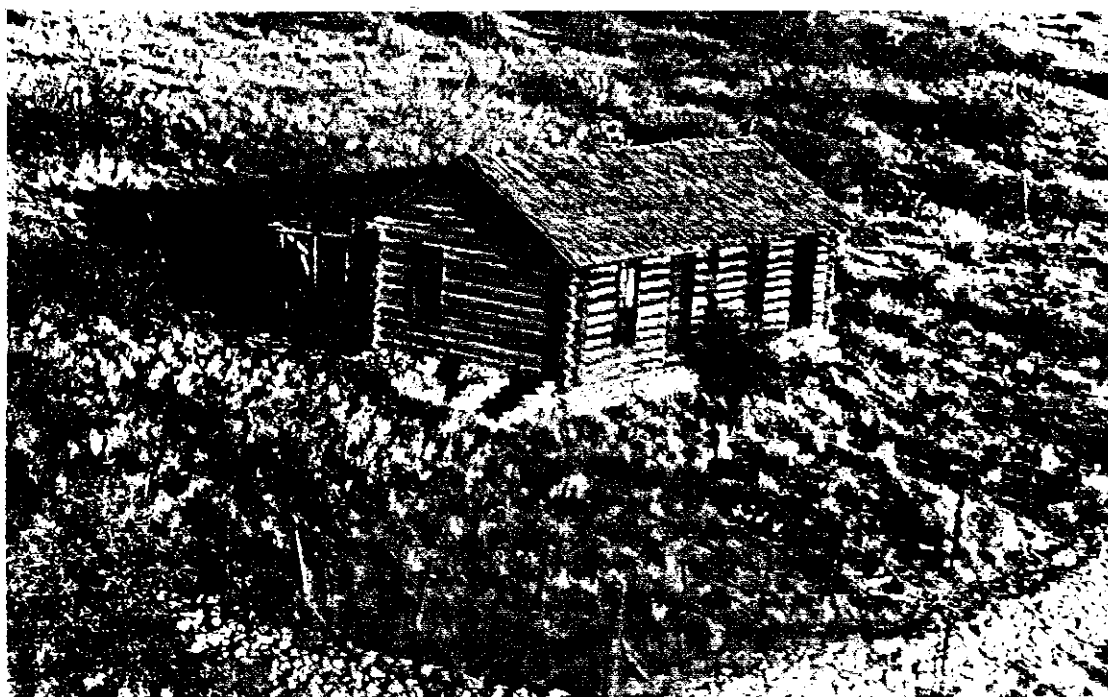


ILLUSTRATION 11 Log cabin. The Les Greer house in lower Lee Canyon is one of the more fully developed log structures on the range. The log houses at White Sands are generally older and in poorer condition than those of board and batten. Source: Field inventory photograph, 1983, William A. Brenner, Building Technology, Inc.

dirt, or adobe roofs are usually in complete ruin; those with intact corrugated metal roofs (particularly those with ample roof overhangs) are often in surprisingly good condition. (Illustrations 12 and 13)

There are a few wood frame houses on the range. Of these, several are stuccoed, and the remainder are covered with horizontal wood siding.

(Illustration 14)

Other structures associated with pre-military ranching activities are corrals and windmills. Corrals were often made of vertical stakes bound with wire, although they could be made of virtually any material including simple barbed wire strung on posts. Windmills are of the variety common throughout the West, and many still display the familiar Chicago Aeromotor logo on their directional vanes. Older windmills have timber towers; later ones are often supported by light guage steel structures. Occasionally a geared pumping mechanism may be found at the base of the windmill. This was linked by a large belt to a gasoline engine (or sometimes to the elevated drive wheel of an automobile) to provide an optional means of pumping water. Holding tanks or reservoirs located close to the windmills were made of galvanized steel, iron, concrete, stone, or, if they were large, simply of mounded earth. The remains of earthen reservoirs are common on the range, as are those of galvanized steel. Concrete and stone tanks are also plentiful, but only a few iron tanks exist. (Illustrations 15 and 16)

An excellent example of a working ranch at White Sands, and the many structures associated with it, is the George McDonald Ranch.

(Also see Illustration 29.)

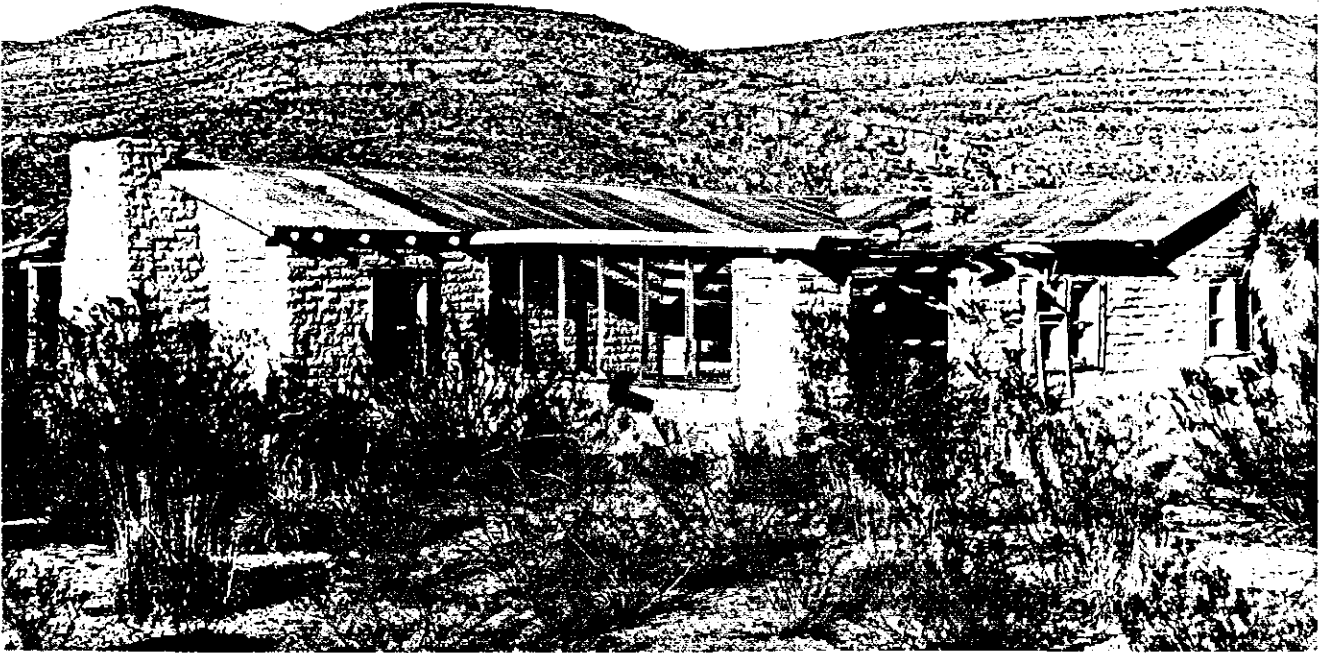


ILLUSTRATION 12 Adobe house. The Burris house near Capitol Peak is a relatively intact adobe structure, largely because of the sound condition of its roof. Obviously at one time a comfortable house, its layout and details suggest that it was built in this century. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

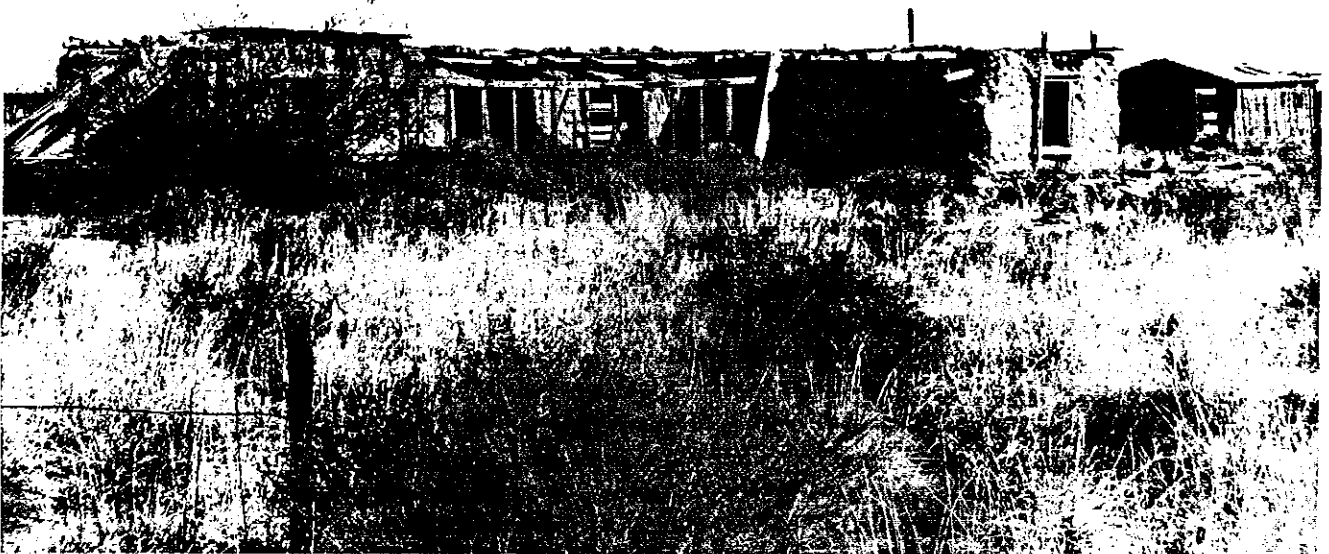


ILLUSTRATION 13 Adobe house at the Ritch ranch. An older and highly deteriorated structure once owned by W. G. Ritch, who was acting territorial governor of New Mexico in 1865. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

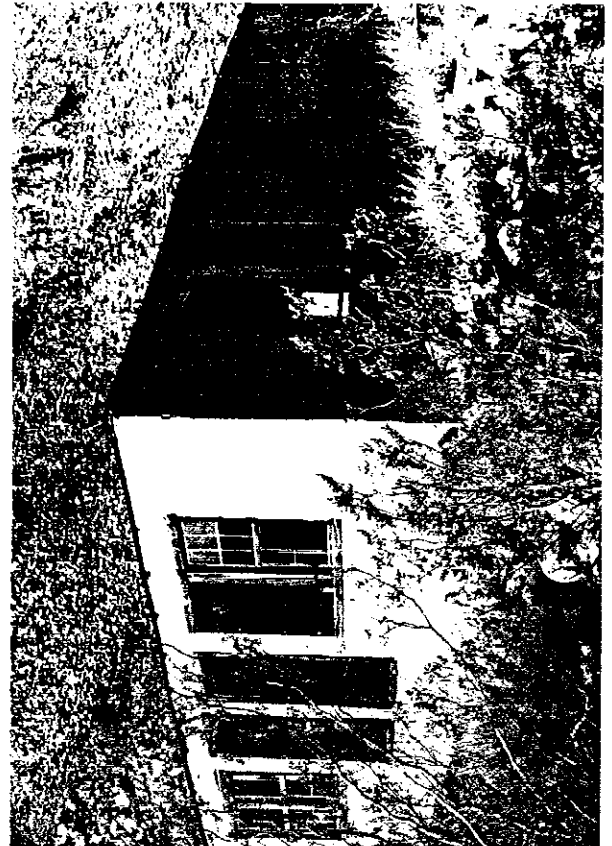
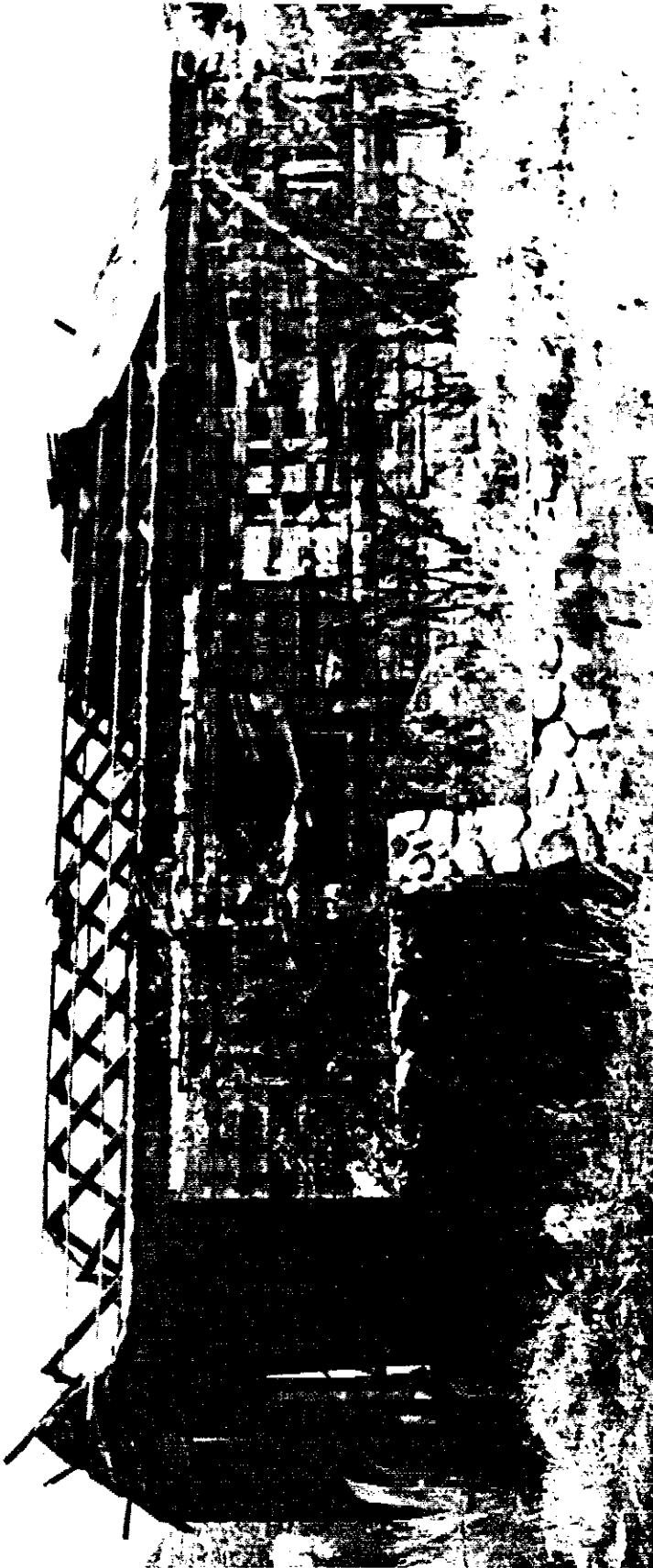


ILLUSTRATION 14

Wood frame houses. There are few wood frame houses at White Sands. Above is the Lena Cox house near Mineral Hill, which was sheathed in horizontal wood siding. Left is the Henderson house at White Rock Well, which is stuccoed. Source: Field inventory photograph, 1983, David G. Buchanan and William A. Brenner, Building Technology, Inc.



ILLUSTRATION 15

Corrals at White Sands. Corral fencing was made of a variety of materials. Top, wood stakes bound together by wire at the Potter Ranch. Middle and bottom, corrals at the George McDonald Ranch. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

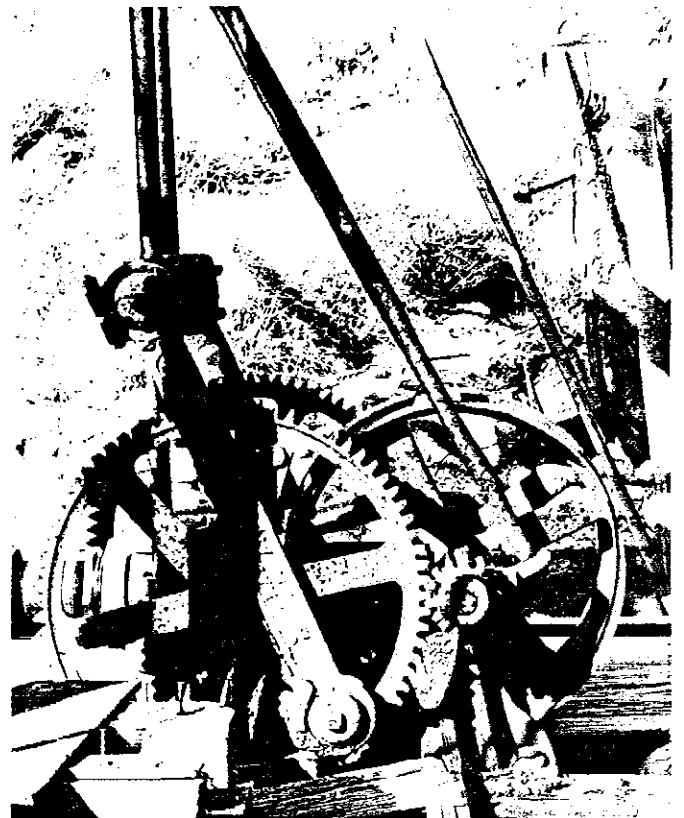
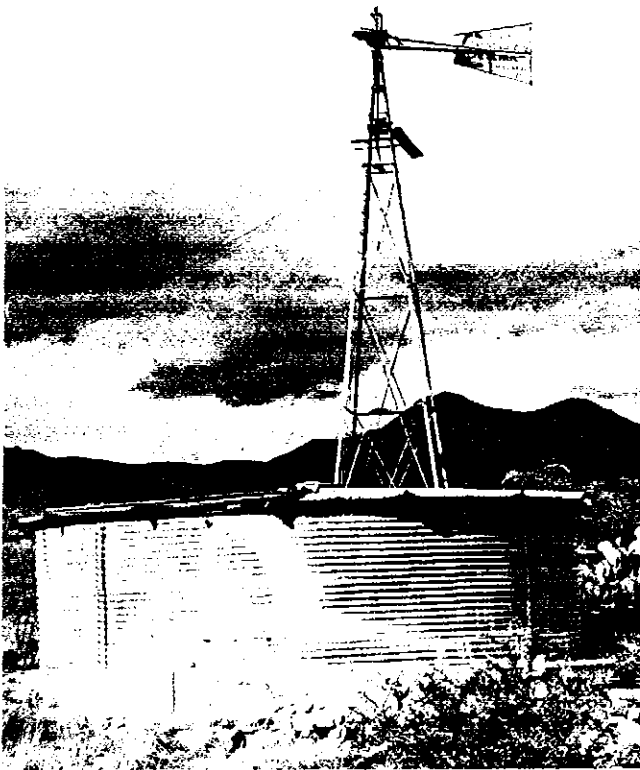
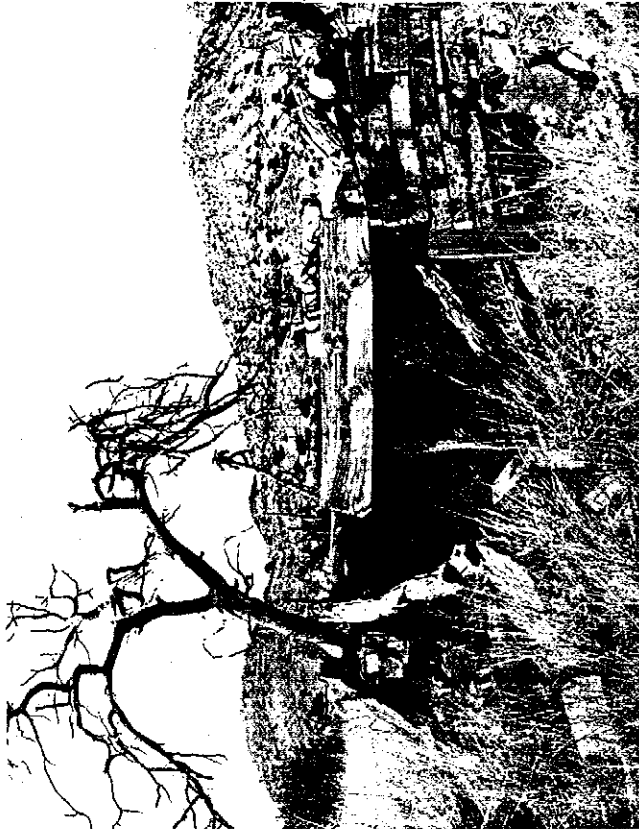


ILLUSTRATION 16 Windmills at White Sands. Many older windmills remain standing on the range. Top, windmill remains at the Frank Martin ranch. This windmill has a tower made of pre-cut wood timbers, typical of the earlier structures. Below left, later light gauge steel tower and corrugated metal tank at the Hal Cox ranch. The windmill mechanism is a "Challenge, Batavia, Illinois." In most cases, tanks or reservoirs were built above ground and located near the windmill. Below right, pump mechanism for use with a gasoline powered engine. It is located at the base of the windmill shown below left, and is inscribed "Alamo Iron Works. San Antonio, Texas." Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.



ILLUSTRATION 17

Dugout house. Unique to White Sands is the Joe Pete Wood dugout north of Bear Den Canyon. The 10' x 10' structure is recessed into the hillside. Portions of a Navaho style log pyramidal roof still remain. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.



One small dugout house is located on the range. It is approximately 10' x 10' and has a "Navaho style" log pyramidal roof. (Illustration 17)

The following is a list of buildings, structures, and sites associated with ranching and mining activities in the area now part of White Sands Missile Range. The list, which is keyed to Illustration 7, also includes properties associated with the Trinity atomic bomb test project. White Sands road map coordinates are shown for each listing, along with the names of applicable USGS 15' topographic maps and 1:50,000 Defense Mapping Agency maps.

1. Mine in upper Texas Canyon. Not surveyed. Artifacts reported to include an abandoned rock crusher. Located in extreme southwest corner of WSMR, southwest of main post area. (WSMR S2 W2; USGS Organ Peak; DMA 4648 I).
2. Henry Heiner mine (may also have been called Silver King mine). Surveyed 2/83. Wood frame house, stone foundation ruins, at least two mine openings, miscellaneous artifacts. Located on eastern slope of San Augustin Peak. (WSMR N4 W4; USGS Organ Peak; DMA 4648 I).
3. Lena Cox ranch. Surveyed 2/83. Wood frame structure with associated outbuildings. Located directly west of Mineral Hill. (WSMR N3 W3; USGS Organ Peak; DMA 4648 I). Illustration 14.
4. Hal Cox ranch. Surveyed 2/83. Assorted stone, adobe, and wood ranch buildings. Yard fenced by stone wall. Largest and most complex building group surveyed at WSMR. Located east of Mineral Hill off west side of Route 208. (WSMR N5 W1; USGS White Sands; DMA 4748 IV).
5. Mineral Hill mining ruins. Surveyed 2/83. Numerous mine openings, several small wood and corrugated metal buildings, assorted mining relics. Steam engine reputed to be located in one of the wood buildings. Primarily located on eastern side of Mineral Hill. (WSMR N4 W1; USGS Organ Peak; DMA 4648 I). Illustrations 4 and 5.
6. Rock house at Rock House Spring. Surveyed 2/83. Very interesting stone structure with stone rubble roof. Pat Garrett and his family may have lived in this house. Located on upper Bear Canyon. (WSMR N10 W4; USGS Bear Peak; DMA 4649 II). Illustration 9.

7. Love ranch headquarters. Surveyed 5/83. Stone house and large cluster of outbuildings. Located north of Bear Creek and Quartzite Mountain. (WSMR N11 W7; USGS Bear Peak; DMA 4649 II).
8. Fillepe Lucero ("lower Lucero") ranch. Surveyed 2/83. Very deteriorated adobe structure with several outbuildings. Located two miles directly east of St. Nicolas Spring, below Route 276. (WSMR N13 E4; USGS Lake Lucero; DMA 4749 III).
9. Jose Lucero ("upper Lucero") ranch. Surveyed 2/83. Adobe structure with roof partially attached. Outbuilding ruins. Located at well east of Coker site on Route 7. (WSMR N18 E3; USGS Lake Lucero; DMA 4749 III).
10. Walter Baird ranch headquarters. Surveyed 2/83. Board and batten wood structure with intact roof. Several outbuildings, including adobe ruin. Located near Baird Site, north of Route 70. (WSMR N20 E12; USGS Lake Lucero; DMA 4749 III).
11. Stone buildings at Ropes Spring. Surveyed 2/83. Three room stone house, with two small stone buildings, probably spring houses. Located on upper Ropes Draw. (WSMR N20 W5; USGS Bear Peak; DMA 4649 II). Illustration 8.
12. Stage station on upper Goldenburg Draw. Surveyed 5/83. Adobe ruins. Located one mile south of Cottonwood Spring. (WSMR N22 W7; USGS Bear Peak; DMA 4649 II).
13. Jack Bruton horse camp headquarters (a.k.a. Jackson horse camp). Surveyed 5/83. Stuccoed frame house and combination rock and adobe house. Located on Horse Camp Draw. (WSMR N27 W9; USGS Kaylor Mountain; DMA 4649 I).
14. Baird horse camp. Surveyed 2/83. Adobe structure in partial ruin, with stone and wood outbuildings. Located about 1-1/2 miles northeast of RAD site, below Mayberry Canyon. (WSMR N28 W1; USGS Kaylor Mountain; DMA 4649 I).
15. Fleck ranch. Surveyed 5/83. Adobe ruin with intact stone barn. Located on Fleck Draw. (WSMR N34 W10; USGS Kaylor Mountain; DMA 4649 I).
16. Frank Anderegg ranch headquarters. Surveyed 2/83. Board and batten house with a relatively large barn, stable, other outbuildings, and ruins. Located between Fleck Draw and Dead Man Canyon in Dead Man water shed. (WSMR N33 W18; USGS Kaylor Mountain; DMA 4649 I).

17. Mrs. Anderegg house. Surveyed 5/83. Board and batten house. Located in middle portion of Dead Man Canyon. (WSMR N32 W4; USGS Kaylor Mountain; DMA 4649 I).
18. Frank Anderegg line camp. Surveyed 5/83. Board and batten house. Located at Doctor's Well in upper Lost Man Canyon. (WSMR N34 W6; USGS Kaylor Mountain; DMA 4649 I).
19. Henderson goat ranch. Not surveyed. Only burned ruins are reported to remain. Located northeast of Hembrillo Pass. (WSMR N38 W9; USGS Kaylor Mountain; DMA 4649 I).
20. Floyd Crockett sheep ranch. Surveyed 5/83. Board and batten house and outbuilding. Located about 2-1/2 miles west of Frank Crockett ranch headquarters and 1/2 mile south of Ben Taylor Tank. (WSMR N44 W13; USGS Kaylor Mountain; DMA 4649 I).
21. Frank Crockett ranch headquarters. Surveyed 2/83. Board and batten house, with several wood and metal covered outbuildings. Located in the middle of Sulphur Canyon. (WSMR N42 W10; USGS Kaylor Mountain; DMA 4649 I).
22. W.G. Ritch ranch. Surveyed 2/83. Adobe structure in partial ruin. Board and batten garage. W.G. Ritch was acting territorial governor of New Mexico in 1865. Located at foot of Grandview Canyon. (WSMR N42 W4; USGS Kaylor Mountain; DMA 4649 I). Illustration 13.
23. Reported stone foundation ruins. Not surveyed. Located one mile east of Bat Ranch Spring. (WSMR N45 W5; USGS Kaylor Mountain; DMA 4649 I).
24. L.H. Makinson house. Surveyed 5/83. Intact board and batten house. Located in lower Grapevine Canyon, one mile north-northwest of Strawberry Peak. (WSMR N46 W6; USGS Kaylor Mountain; DMA 4649 I).
25. Line camp at Walson Well. Surveyed 2/83. Small stone structure with no apparent outbuildings. Located one mile east of Walson Gap. (WSMR N46 W12; USGS Black Top Mountain; DMA 4650 II).
26. A.C. Woolf ranch headquarters. Surveyed 2/83. Large adobe house with large porch, three stone fireplaces, French doors, and other architectural features. Few ancillary structures. Most architecturally developed ranch house of those surveyed. Located in Hackberry Canyon. (WSMR N50 W14; USGS Black Top Mountain; DMA 4650 II).
27. Wood ruins at Woolf Spring. Surveyed 2/83. Ruins of small log building and wood shack. Located in Cottonwood Canyon. (WSMR N50 W10; USGS Black Top Mountain; DMA 4650 II).
28. Rock house at Rock House Well. Surveyed 2/83. L-shaped stone building with corral. Located in Cottonwood Canyon north of Black Top Mountain. (WSMR N51 W11; USGS Black Top Mountain; DMA 4650 II).

29. Oscar Nelson camp at Nelson Well. Surveyed 2/83. Small board and batten house with wood corral. Located about 1/2 mile west of Route 7. (WSMR N50 W3; USGS Black Top Mountain; DMA 4650 II).
30. Henderson house at G. Henderson Well. Surveyed 5/83. Adobe ruin. Located about 1/2 mile west of Route 7 and directly east of Gunsight Peak. (WSMR N52 W2; USGS Black Top Mountain; DMA 4650 II).
31. Reported sheep shed. Not surveyed. Located at windmill one mile south-southwest of Red Hill Well, upper Cottonwood Canyon. (WSMR N52 W14; USGS Black Top Mountain; DMA 4650 II).
32. Potter ranch headquarters. Surveyed 2/83. Building complex includes board and batten house and barn, adobe house, log outbuilding, metal shed, and board and batten sheep shearing shed. Also several wood corrals, a windmill, and related structures. Located at Towner Well, middle Rhodes Canyon on Route 6. (WSMR N55 W11; USGS Black Top Mountain; DMA 4650 II). Illustration 10.
33. CCC camp site. Surveyed 2/83. Only two stone gate markers, several concrete slabs, and miscellaneous remnants remain. Located on the south side of Route 6, middle Rhodes Canyon, about 1/4 mile northwest of Rock House Spring. (WSMR N57 W13; USGS Black Top Mountain; DMA 4650 II).
34. "Potsy" Potter sheep ranch. Surveyed 2/83. Board and batten house, garage, and two small outbuildings. Located near the middle of Rhodes Canyon on Route 6. (WSMR N56 W11; USGS Black Top Mountain; DMA 4650 II).
35. Remains of CCC road improvements. Surveyed 2/83. Stone walls, culverts, and related road improvements are visible along Route 6 between Hardin Ranch and Rhodes Canyon Range Center. (WSMR N55-58 W5-15; USGS Black Top Mountain; DMA 4650 II).
36. Henderson house at Tip Top Ranch. Surveyed 2/83. Adobe house and wood frame house. Located off eastern end of Rhodes Canyon. (WSMR N55 W6; USGS Black Top Mountain; DMA 4650 II).
37. Henderson house at White Rock Well. Surveyed 2/83. Wood frame house with adobe stucco. Located in Mackinson Canyon. (WSMR N58 W6; USGS Black Top Mountain; DMA 4650 II). Illustration 14.
38. F.E. Henderson house. Not surveyed. Only a shed is reported to remain. Located at Bear Den Tank in Bear Den Canyon. (WSMR N57 W13; USGS Black Top Mountain; DMA 4650 II).
39. Miller ranch headquarters. Surveyed 2/83. Board and batten house with several extensions. Located in western end of Rhodes Canyon on Route 6. (WSMR N58 W14; USGS Black Top Mountain; DMA 4650 II).

40. Eugene Manlove Rhodes grave site. Surveyed 2/83. Fenced-in site, with stone grave marker and bronze plaque. Located about 3/4 mile west of Miller Ranch on Route 52. (WSMR N59 W15; USGS Black Top Mountain; DMA 4650 II). Illustration 53.
41. Hardin ranch. Surveyed 2/83. Stone house, stone outbuilding with tank, metal barn, wood corral, related outbuildings. Ranch now used by WSMR range inspectors. Located in western end of Rhodes Canyon on Route 5. (WSMR N60 W14; USGS Salinas Peak; DMA 4650 I). Illustration 52.
42. Pete Wood ranch. Surveyed 2/83. Stone house, small log shed, stone outbuilding with tank, and related structures. Located off Route 5 at northern end of Bear Den Canyon. (WSMR N61 W13; USGS Salinas Peak; DMA 4650 I). Illustration 9.
43. Joe Pete Wood dugout house. Surveyed 2/83. Remains of small dugout house with log pyramidal "Navaho style" roof. Located on the east side of Route 5, about one mile north of Pete Wood Ranch. (WSMR N62 W10; USGS Salinas Peak; DMA 4650 I). Illustration 17.
44. Henderson house at Tipton Spring. Surveyed 2/83. Board and batten house with metal roof, small wood outbuilding. Located in the lower end of Good Fortune Canyon. (WSMR N61 W8; USGS Salinas Peak; DMA 4650 I).
45. Stone house near Good Fortune Spring. Surveyed 2/83. Stone house with wood barn ruins. Located at the head of Good Fortune Canyon. (WSMR N63 W8; USGS Salinas Peak; DMA 4650 I).
46. John Wood ranch. Surveyed 2/83. Board and batten house with partial asphalt shingle wall covering. Several ancillary wood structures. Located on the east side of Route 5 near Gyp Gap. (WSMR N64 W10; USGS Salinas Peak; DMA 4650 I).
47. Roy Tucker house at Grapevine Spring. Surveyed 2/83. L-shaped board and batten house with metal roof. Located south of Route 13 at southern end of Grapevine Canyon. (WSMR N64 W6; USGS Salinas Peak; DMA 4650 I).
48. George ranch. Surveyed 5/83. Ruins of board and batten house. Located at Sweetwater Spring in Sweetwater Canyon. (WSMR N62 W3; USGS Salinas Peak; DMA 4650 I).
49. Dick Gilliland ranch. Surveyed 2/83. Board and batten house with several outbuildings. Located on Route 5, about four miles northeast of Cain ranch and across road from Bear Den School site. (WSMR N69 W10; USGS Salinas Peak; DMA 4650 I).
50. Bear Den School site. Surveyed 2/83. Only floor and small cellar remain among wood wreckage. Appears to have been a one-room wood frame or board and batten building. Located on the east side of Route 5, across from Gilliland ranch. (WSMR N70 W10; USGS Salinas Peak; DMA 4650 I).

51. Martin line camp. Surveyed 5/83. Small board and batten house. Located at Martin Well off Route 13. (WSMR N71 W5; USGS Salinas Peak; DMA 4650 I).
52. L.W. Well log house. Surveyed 2/83. Log house with stone chimney. Windmill is only apparent associated structure. Located on Route 13 at northern end of Grapevine Canyon. (WSMR N66 W6; USGS Salinas Peak; DMA 4650 I).
53. Amlin Wood house. Surveyed 2/83. Stone house with two stone outbuildings. Associated structures include windmill, sheds, and corrals. Located at Thurgood Well, upper Thurgood Canyon. (WSMR N67 W3; USGS Salinas Peak; DMA 4650 I).
54. Les Greer ranch. Surveyed 2/83. Intact board and batten house with metal roof. Nearby log cabin, also relatively intact. Located at Juniper Well in lower Lee Canyon. (WSMR N64 O; USGS Capitol Peak; DMA 4750 IV). Illustration 11.
55. Greer line camp. Surveyed 2/83. Log cabin, appears to be built in two sections. Located near Sheep Mountain Spring on the north slope of Sheep Mountain. (WSMR N67 E2; USGS Capitol Peak; DMA 4750 IV).
56. Stone house. Surveyed 2/83. Small stone structure with highly deteriorated roof. Located about 1/2 mile east of Brown Well. (WSMR N70 W2; USGS Salinas Peak; DMA 4650 I).
57. Thurgood ranch. Surveyed 2/83. Adobe house with adobe roof, ruins of a stone house, and related structures. Located in Thurgood Canyon, about 1-1/2 miles west of Lava Gap. (WSMR N69 E1; USGS Capitol Peak; DMA 4750 IV).
58. Burris ranch. Surveyed 2/83. Relatively large adobe structure with mostly intact metal roof. Associated outbuildings. Located at Burris Well, two miles north-northwest of Capitol Peak. (WSMR N72 E2; USGS Capitol Peak; DMA 4750 IV). Illustration 12.
59. Frank Martin ranch headquarters. Surveyed 2/83. Wood frame house with asphalt shingle siding. Board and batten storage shed, related structures. Located near the Socorro/Sierra county line approximately equivalent between Routes 5 and 13. (WSMR N75 W8; USGS Salinas Peak DMA 4650 I).
60. Mike Arrieta Ranch (a.k.a. part of Harriet ranch). Surveyed 2/83. Only partially collapsed small wood structure remains. Located at Lewis Well, one mile west of Route 13. (WSMR N78 W5; USGS Granjean Well; DMA 4651 II).
61. McDonald brothers ranch (site of Trinity Base Camp). Surveyed 2/83. Complex adobe shed roof house, wood frame house, elevated water tank, wood shed, and concrete foundations of several base camp buildings. Located at bend in Route 13, 1/4 mile north of Pond Site. (WSMR N81 W4; USGS Granjean Well; DMA 4651 II). Illustrations 26 and 27.

62. Tom McDonald ranch at Mockingbird Gap Well. Surveyed 2/83. Board and batten bunkhouse, stone and wood-fenced corrals. Ranch house previously demolished. Located near junction of Routes 7 and 12 at Ben Site. (WSMR N79 E4; USGS Mockingbird Gap; DMA 4751 III).
63. George Foster ranch. Surveyed 2/83. Adobe house with adobe roof in partial collapse. Collapsed adobe outbuilding. Grave of Mrs. Foster located nearby. Located near Foster Well, about 3/4 mile off Route 7 on access road to Stallion W.I.T. (WSMR N85 W3; USGS Granjean Well; DMA 4651 II).
64. George McDonald ranch (assembly site of the plutonium core for the first atomic bomb). Surveyed 2/83. Adobe house with stone outbuildings. Located two miles south-southeast of Trinity Site. (WSMR N88 E1; USGS Mockingbird Gap; DMA 4751 III). Illustration 29 and Appendix A.
65. Charles Story ranch (a.k.a. Baber ranch). Surveyed 5/83. Ruins of adobe structure and two stone outbuildings. Located approximately one mile northwest of Trinity Site. (WSMR N90 W1; USGS Mockingbird Gap; DMA 4751 III).
66. Cicero Green ranch. Surveyed 5/83. Large adobe house in partial ruin. Located near Green Site on Route 349. (WSMR N92 W9; USGS Granjean Well; DMA 4651 II).
67. Trinity Site. Surveyed 2/83. A national landmark. Fenced-in area with lava stone marker and bronze plaques. Remains of "Jumbo," an unused steel containment vessel, and several reinforced concrete instrumentation bunkers are located nearby. (WSMR N38 O; USGS Mockingbird Gap; DMA 4951 III). Illustrations 18-22.
68. Houses at Smith Tank. Surveyed 5/83. Intact concrete house and adjacent ruins of stone house. Located about two miles northwest of North Oscura Peak. (WSMR N96 E5; USGS Bingham; DMA 4751 IV).
69. Ozane stage station. Surveyed 5/83. Ruins of large stone building, with ruins of smaller structure across road. Located approximately three miles northwest of North Oscura Range Center. (WSMR N96 E9; USGS Bingham; DMA 4751 IV).
70. Manuel Moya house. Surveyed 2/83. L-shaped stone structure with collapsed sod roof. Located at Moya Tank on Route 9, one mile south of Routes 9 and 331 intersection. (WSMR N93 E9; USGS Mockingbird Gap; DMA 4751 III). Illustration 8.
71. Yates shack. Surveyed 2/83. Small shack with metal shed roof. Walls are partially board and batten and partially corrugated metal. Located at Yates Tank, about one mile below Moya site. (WSMR N92 E9; USGS Chihuahua ranch [a.k.a. Bull Gap]; DMA 4751 II).

72. Art Helm homestead. Surveyed 2/83. Highly intact board and batten house with metal roof. Collapsed wood outbuilding. Located at Helm Tank, east slope of Oscura Mountains and south of Workman Ridge. (WSMR N91 E8; USGS Mockingbird Gap; DMA 4751 III).
73. H.B. Helm house. Surveyed 2/83. Small stone house with metal shed roof, above ground cistern. Located near Dillard Whitmore Well in Whitmore Canyon on east slope of Oscura Mountains. (WSMR N90 E9; USGS Mockingbird Gap; DMA 4751 III).
74. Stone ruin. Surveyed 2/83. Located below Dripping Spring, east slope of Oscura Mountains. (WSMR N88 E9; USGS Mockingbird Gap; DMA 4751 III).
75. R.C. Withers ranch. Surveyed 2/83. Adobe structure, now roofless. Located at R.C. Withers Tank on southwest slope of Flat Top Mountain. (WSMR N92 E14; USGS Mockingbird Gap; DMA 4751 III).
76. Stage station. Surveyed 5/83. Ruins of two stone buildings. Located at Red Canyon Spring in Red Canyon. (WSMR N93 E15; USGS Chihuahua Ranch [a.k.a. Bull Gap]; DMA 4751 II).
77. Estey City. Surveyed 2/83. Stone building ruins at site of former Estey City mining district. Located on east slope of Oscura Mountains northeast of Mockingbird Gap. (WSMR N82 E12; USGS Mockingbird Gap; DMA 4751 III). Illustration 6.
78. House at Sholle Well. Surveyed 5/83. Ruins of stone house and wood structure. Located at Sholle Well, south of Estey City. (WSMR N81 E12; USGS Mockingbird Gap; DMA 4751 III).
79. Lathan ranch. Not surveyed. Building ruins may remain. Located on Route 312 at base of Phillips Hills, directly west of Phillips Site. (WSMR N72 E19; USGS Three Rivers; DMA 4750 I).

THE TRINITY TEST

The world's first atomic bomb was detonated on July 16, 1945 at Trinity Site, located in the northwestern region of White Sands Proving Ground. Ground Zero, the site of the detonation, is now enclosed in a circular fence, 1,600 feet in radius. The Army erected a monument of lava stone in 1965 as a permanent marker to commemorate the event. In 1972, Trinity Site was listed on the National Register of Historic Places and designated a National Historic Landmark.¹⁵ (Illustration 3)

The site chosen for the test had been, until three days before the detonation, a portion of the Alamogordo Bombing Range. It is called "Trinity" after the code word for the highly secret project, the name selected by Dr. J. Robert Oppenheimer, the project's scientific director. Work at the site began late in 1944, and by May, 1945 preparations were completed for a test shot of 100 tons of high explosive laced with a small amount of fissionable material. The test was to provide data for the calibration of test instruments and to serve as a dress rehearsal for the functioning of the test organization. It was successfully conducted on May 7 in a dramatic detonation that was eclipsed only by the atomic explosion two months later.¹⁶

The atomic test was set for 4 a.m. on Monday, July 16th. The bomb had been assembled on July 13th and placed atop a 100-foot steel tower on the 14th. Early in the morning of the 16th, scientists, technicians, and Army personnel took their places in the old reservoir at Base Camp and in bunkers 10,000 yards to the south, west, and north of Ground Zero. Rain delayed the detonation for one and one-half hours, but at 5:29:45 a.m. the bomb exploded in a blast that exceeded all but the most optimistic scientific expectations.¹⁷ (Illustration 18)

Major sites associated with the Trinity test are: Ground Zero; Jumbo; camera, instrumentation, and personnel bunkers to the north, west and south of Ground Zero; the MacDonald Ranch, two miles to the southeast of Ground Zero; and Base Camp, nine miles to the south of Ground Zero. (Illustration 19)

Ground Zero is marked by a stone obelisk bearing the national historic landmark plaque near the remains of the four concrete piers that supported the bomb tower. The barely noticeable depression caused by the blast is 800



100 METERS

NORTH

28 HOURS
VERTICAL

ILLUSTRATION 18 An aerial photograph of Trinity Site 28 hours after the nuclear explosion occurred. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

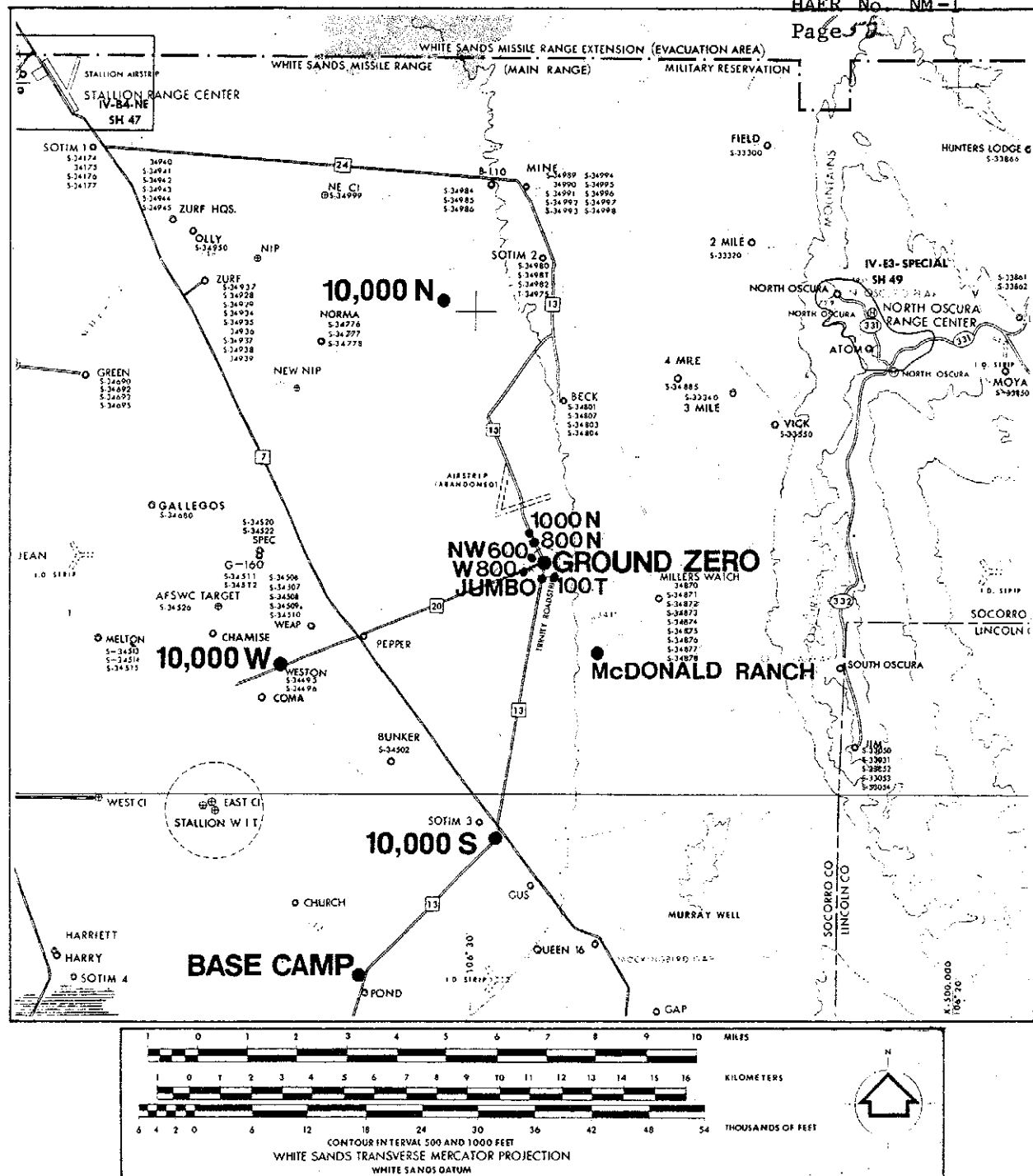


ILLUSTRATION 19 Trinity Site. Landmarks include Ground Zero; the present location of Jumbo; instrumentation bunkers at 800 yards west, 600 yards northwest, 800 yards north, and 1,000 yards north; the site of the 100 tons (100T) TNT test explosion; the McDonald Ranch, where the active nuclear core materials for the bomb were assembled; the personnel and camera bunkers at 10,000 yards north and 10,000 yards west; the site of the control bunker at 10,000 yards south (now demolished); and the site of Base Camp, where 200 personnel were stationed during the test preparations. Source: Building Technology, Inc. and WSMR Master Plan Basic Information Maps, October, 1970.

feet in radius and several feet deep at the point of explosion. It is littered with particles of "trinitite" (sand and dirt fused into a glass-like substance by the blast). Shortly after the explosion, a wooden shelter was erected several hundred feet from Ground Zero to preserve intact a section of trinitite. Currently, two large concentric circles of cyclone fencing protect Ground Zero. (Illustrations 20 and 21)

Jumbo is located near the entrance to Ground Zero. This massive iron cylinder was designed for a contained test of the bomb. The test was cancelled in favor of the uncontained test that actually took place, and Jumbo was never used. The atomic explosion destroyed the 60-foot high structure located northwest of Ground Zero that supported Jumbo, but Jumbo itself was not damaged. Its hemispherical ends were removed in a later salvage attempt, but complete demolition was unsuccessful, and it was eventually moved to its present location at the entrance to Ground Zero. (Illustration 22)

Eight hundred yards west of Ground Zero stands a small concrete instrumentation bunker built on an earthen mound. This unmanned bunker housed instruments to provide data on the test. There are three other instrumentation bunkers at North 800 yards and North 1000 yards and at Northwest 600 yards. All four bunkers are largely intact, but are gradually deteriorating. (Illustrations 23 and 24)

At the time of the test, a personnel bunker and command center under the direction of Dr. Robert Oppenheimer stood at South 10,000 yards, and personnel and camera bunkers were located at North 10,000 and West 10,000 yards.

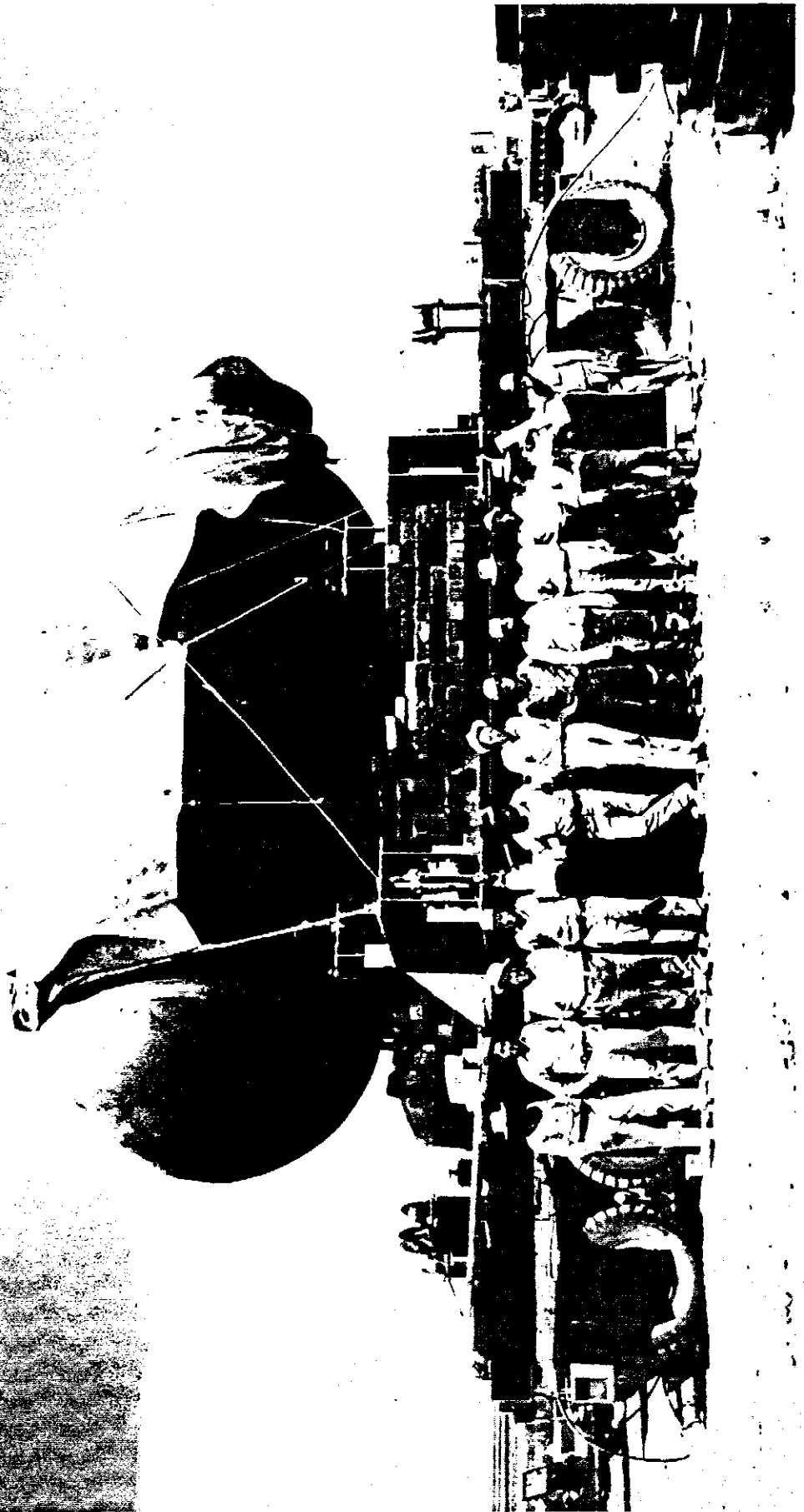


ILLUSTRATION 20 Monument erected at Trinity Site in 1965 to commemorate the detonation of the world's first nuclear bomb on July 16, 1945. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

ILLUSTRATION 21 Dr. Robert Oppenheimer, General Groves (in the center), and others inspecting the remains of the steel drop tower at Trinity Site following the detonation of the bomb. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.



ILLUSTRATION 22 The arrival of "jumbo", the container designed to save the plutonium core, at Trinity Site during July 1945.
Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.



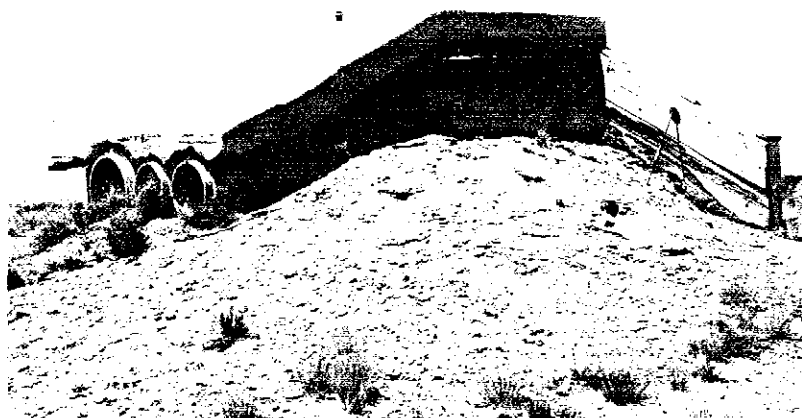
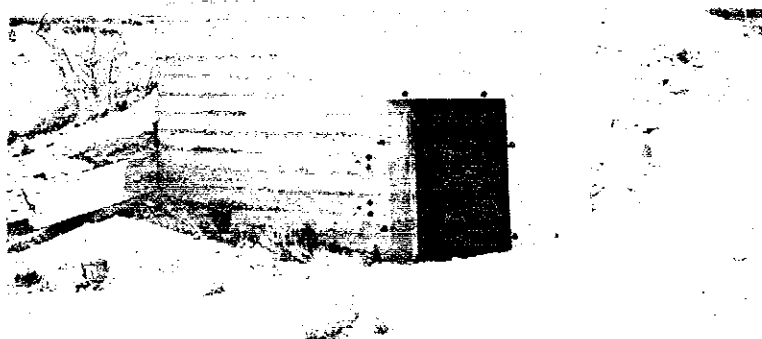
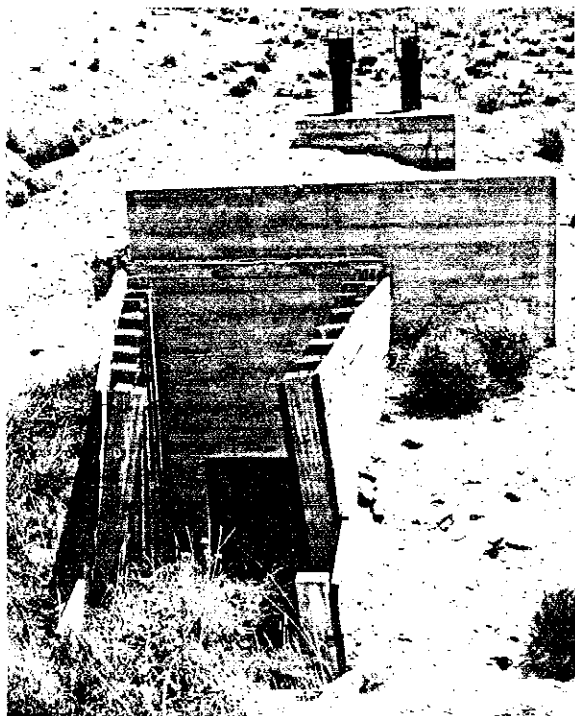
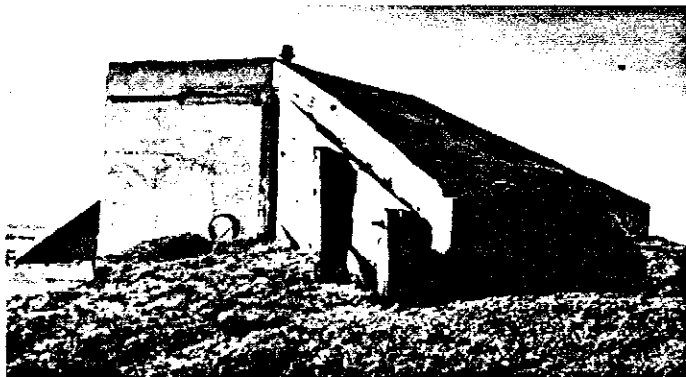


ILLUSTRATION 23 Instrumentation bunkers at Trinity Site. Top, bunker at 800 yards west of Ground Zero. Middle left, bunker at 600 yards northwest. Middle right, bunker at 1,000 yards north. Bottom, bunker at 800 yards north. Source: Field inventory photographs, David G. Buchanan, Building Technology, Inc., and WSMR Photographic Laboratory, 1983.

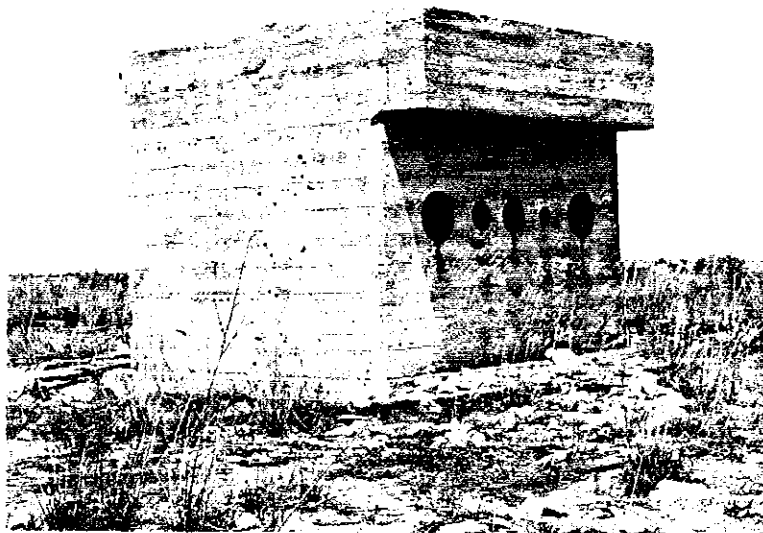
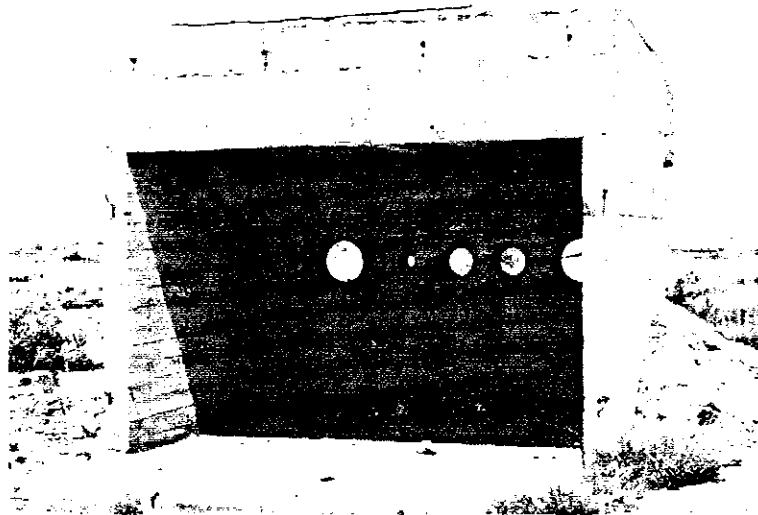


ILLUSTRATION 24 Camera bunkers at Trinity Site. Top, bunker 10,000 yards west of Ground Zero. Bottom, bunker at 10,000 yards north. Bunkers were adjacent to earth-covered personnel bunkers that have since been demolished. Source: WSMR Photographic Laboratory, 1983.

Today only the camera bunkers at North 10,000 and West 10,000 remain. They are square concrete structures, approximately nine by nine by nine, with no rear walls and with several observation apertures on the sides facing Ground Zero. The three personnel bunkers at North, West, and South 10,000, which were made of timber with earth-covered concrete roofs, have since been demolished. (Illustration 25)

Base Camp was located at the former McDonald brothers ranch approximately nine miles south-southwest of Ground Zero. Of the facilities that housed the 200 men working on the Trinity test, only a wood frame house, an adobe house, and a small wood shed still stand, all in poor condition. The concrete floor of the generator house is located between the two houses, and behind them are the concrete floors of a latrine and garage. An earthen reservoir, two wooden water tank platforms (one still holding a wood tank), and the remains of a windmill are sited north of the houses. The many temporary wood frame hutments used by the Army were removed after the test. (Illustrations 26 and 27)

On July 13, 1945, scientists at the George McDonald ranch house, two miles southeast of Ground Zero, assembled the bomb's active nuclear materials (which had been delivered the previous day from the Los Alamos Scientific Laboratory). Prior to the war, the McDonald ranch house was the center of an active and highly developed ranching complex that included, besides the main house, two cisterns, a bunkhouse, a sizeable garage/barn, a large, two-part concrete water tank fed by a well with a Chicago Aeromotor windmill, a root cellar, several sheds, and a number of corrals and associated feeding

ILLUSTRATION 25 South observation bunker, photograph taken in July, 1945.
Source: U.S. Army Photograph, Public Affairs Office,
White Sands Missile Range.



Base Camp at the McDonald brothers' ranch in the summer of 1945. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

ILLUSTRATION 26

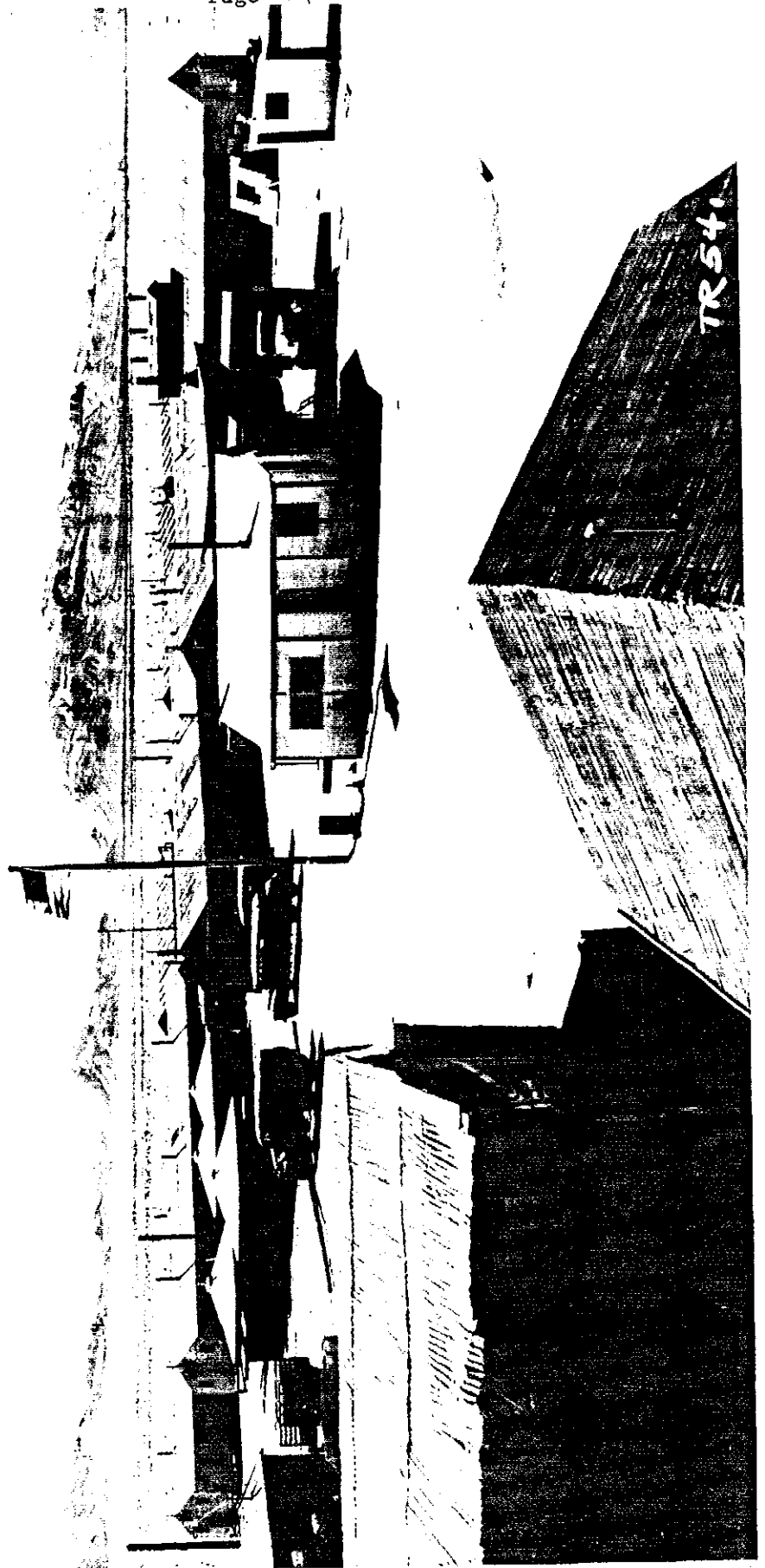
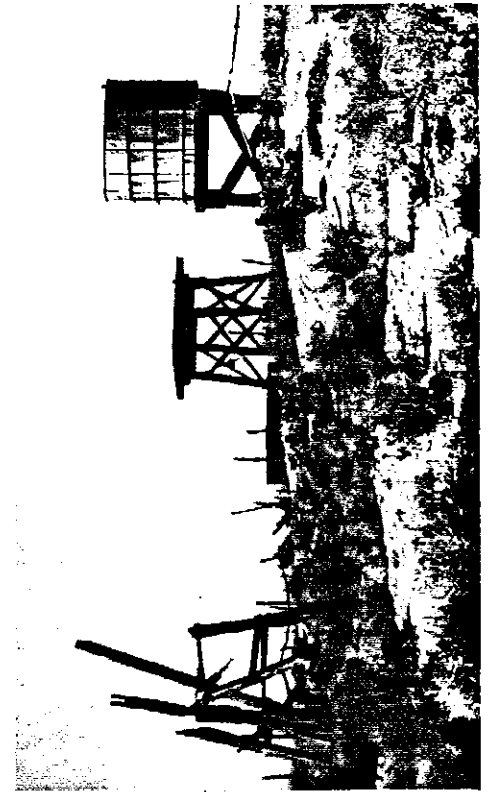




ILLUSTRATION 27

Site of Base Camp today. All that remains standing are the adobe ranch house, a wood frame house and shed, and remnants of two water tanks and a windmill adjacent to a large earthen reservoir. Just south of these buildings are several concrete slabs, the only remnants of the temporary structures built by the Army. The concrete slabs are said to be the former floors of a generator house, latrine, and garage. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.



and watering devices. The ranch structures were not seriously affected by the detonation, but are now in disrepair. The Army is currently stabilizing the ranch house. (Illustrations 28 and 29)

Myriad communication and power lines, strung between poles or over scrub growth, ran from Ground Zero to the various bunkers and Base Camp. Several lines and poles still exist; some are erect, but most have fallen to the ground.¹⁸

EARLY DEVELOPMENT AT WHITE SANDS

Early in 1945, the Army Ordnance Department selected the Tularosa Basin in southern New Mexico as the site of a permanent land range for the test firing and recovery of guided missiles and rockets. The 100 mile by 40 mile site was adjacent to both Fort Bliss, a permanent Army post at El Paso, Texas, and the Alamogordo Army Air Base (now Holloman Air Force Base) at Alamogordo, New Mexico. The local climate and geography of the region were conducive to rocket testing -- the arid land was almost void of vegetation, the sky was cloudless most of the year, and the San Andres and Sacramento Mountains bordering the area afforded natural locations for observing and tracking flights. The entire region was only sparsely populated -- no major towns or industries were located on the proposed range -- and only a few small mines and a number of widely separated ranch houses were situated in the region. No railroad or air lines traversed the site, and only one major road, U.S. Route 70, crossed the Tularosa Basin.¹⁹

In February, 1945, the Army declared the use of the area a military necessity. Portions of the site were acquired from the Fort Bliss Antiaircraft Range,

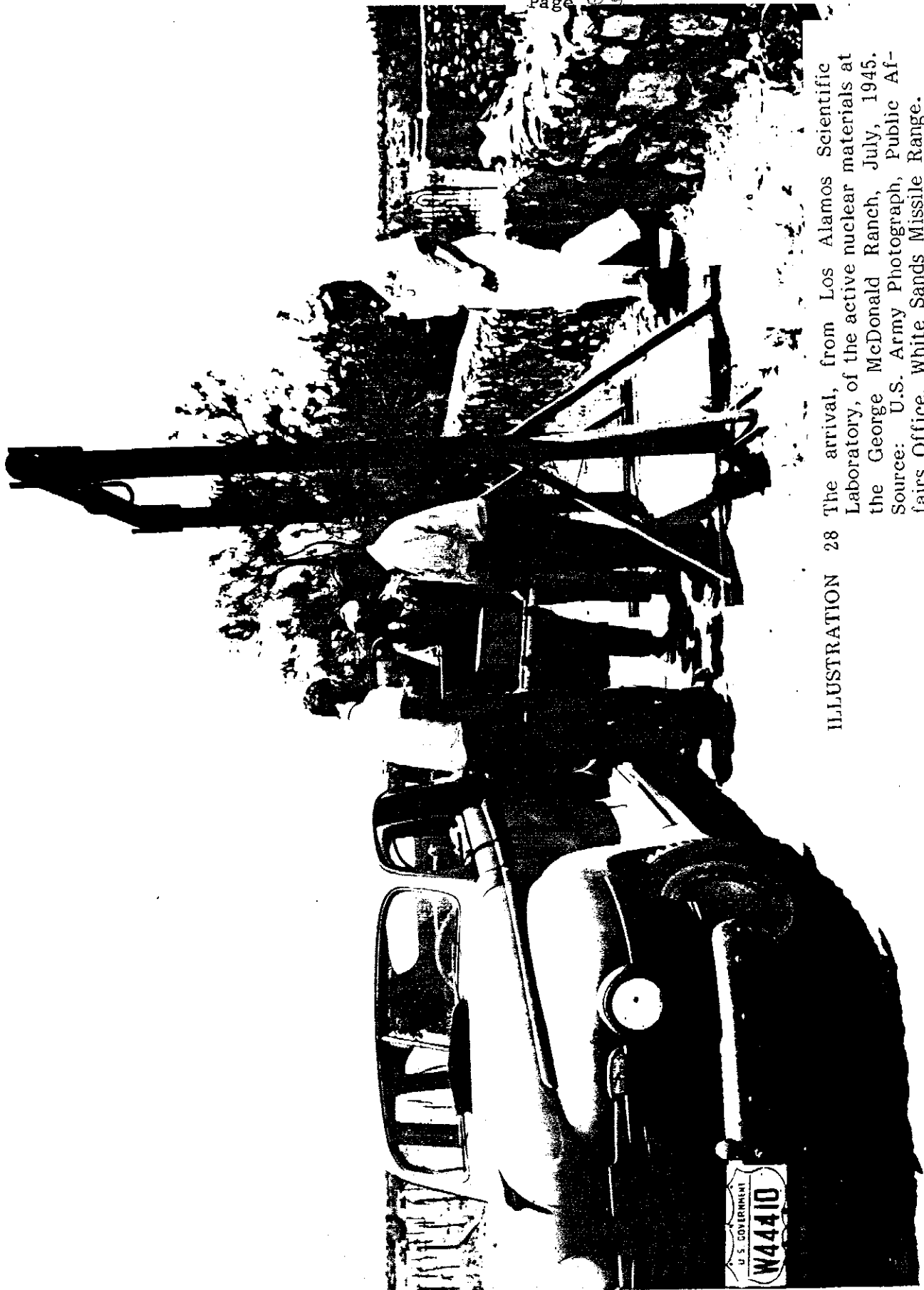


ILLUSTRATION 28 The arrival, from Los Alamos Scientific Laboratory, of the active nuclear materials at the George McDonald Ranch, July, 1945.
Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

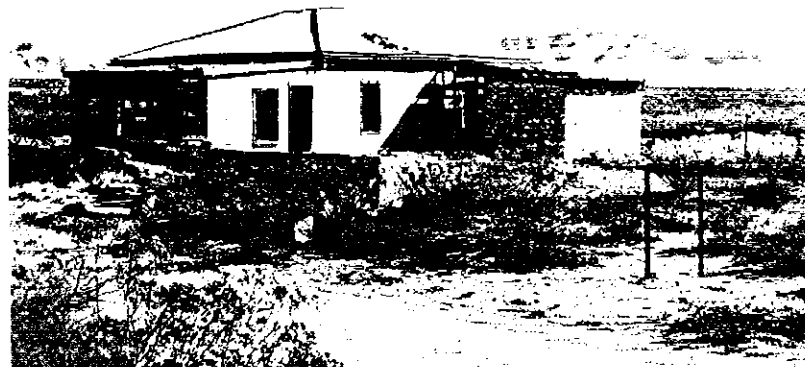
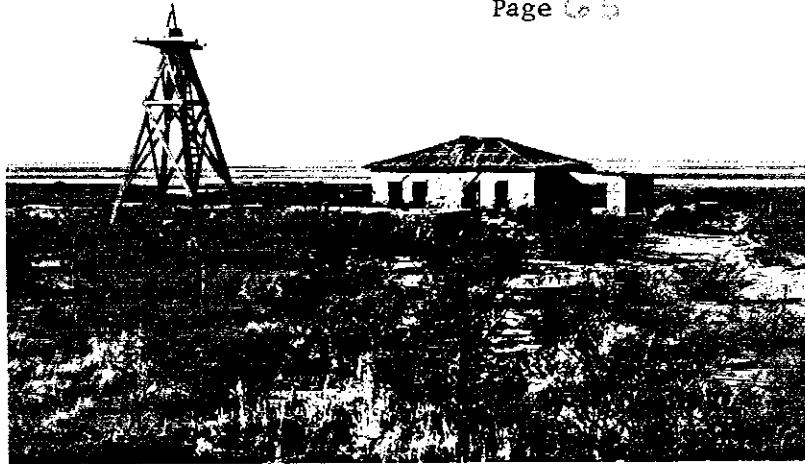


ILLUSTRATION 29

The George McDonald Ranch as it exists today. The Army is now in the process of stabilizing the ranch house.
Source: White Sands Photographic Laboratory, 1983.

the Dona Ana Target Range, the Castner Target Range, and the Alamogordo Bombing Range. White Sands National Monument and the Jornada Experimental Range also lay within the confines of the area. Additional land was acquired or leased from private owners or state and local governments.²⁰

Co-use agreements were made with a number of ranchers that required them to vacate their properties for limited periods during test firings. These proved unworkable, however, and in March, 1949, the Army acquired the ranches on an exclusive use basis. Meanwhile, the New Mexico State Highway Department had declared the previous November that U.S. Route 70 was a military highway subject to periodic closings.²¹

Following the establishment of White Sands in early 1945, the Corps of Engineers began construction of the main post area in the southwest corner of the base. The main post was planned in four quadrants: the administration and troop area, the technical area, the industrial and warehouse area, and the quarters and parade ground area. Temporary CCC buildings and a hangar were moved to the site from Sandia Air Base near Albuquerque, and Dallas type hutments, 16 x 16 feet, were constructed of plywood to provide accommodations for military troops. A huge metal quonset hut (Building 1538) was constructed as the missile assembly facility for the V-2 rocket program. This building, and a small blockhouse (Building 1592) west of it, are the only World War II era structures remaining in the main post area.²² (Illustrations 30, 52, and 55) The blockhouse was associated with an early Propulsion Unit Calibration Stand, built under the direction of Werner Von Braun in July 1946, that has been since dismantled.

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ILLUSTRATION 30 Aerial view of the main post area of White Sands in 1946. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.



Missile firing facilities were located approximately 6-1/2 miles east of the main post. Construction of the first launch area, now Launch Complex 33, began in July, 1945 with erection of the Army blockhouse (Building 20814). It housed firing controls, communication equipment, and instruments for recording rocket test flights. The 60' by 40' reinforced concrete building has heavy walls and a thick pyramidal roof designed to withstand the impact of a rocket falling freely from an altitude of 100 miles.²³

The first permanent launch site, merely a concrete pad, was completed in May, 1946, but was superseded in November by a new launch facility with a gantry crane (Building 20820) and a specially designed launch pad with a blast deflector and water spillway. The gantry crane, a 75 foot steel tower with four work platforms, was built on tracks so that it could roll forward to service and prepare V-2 rockets for flight tests, then roll away from the launch site during actual rocket firings.²⁴ (Illustrations 31-34)

From 1946 through 1951, a total of 67 V-2 rockets were launched and tested at this site. Launch Complex 33 remains virtually intact; both the V-2 gantry crane and the Army blockhouse are in good condition. The blockhouse is still in use and the gantry crane has recently been cleaned and painted. The complex was listed on the New Mexico Register of Cultural Properties in 1977 (Property No. 0580).²⁵ (Illustration 35)

In 1946, the Naval Ordnance Missile Test Facility at White Sands constructed its own rocket firing facilities two miles east of the Army blockhouse at what is now Launch Complex 35. A launch pad and two steel launch towers (Buildings 23230 and 23231) were completed in 1946 to facilitate testing of the Aerobee and other early Navy missiles. The Navy's reinforced concrete

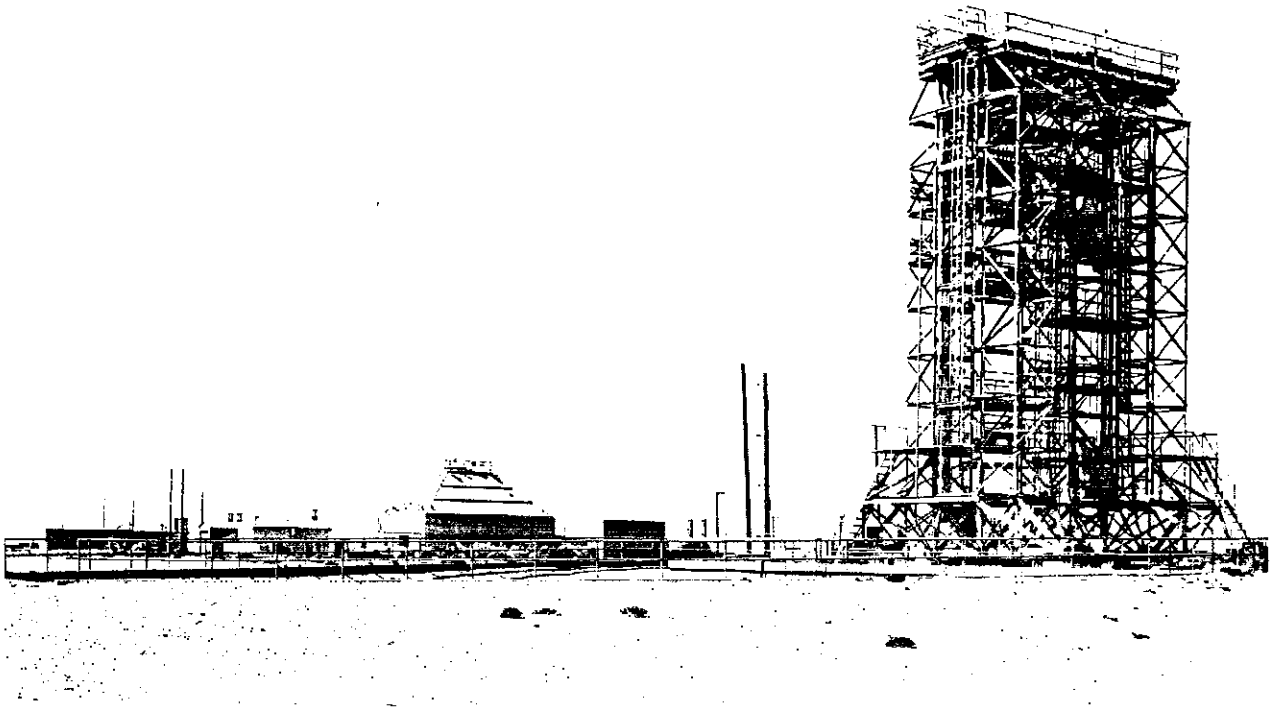


ILLUSTRATION 31 Army blockhouse and V-2 gantry crane, photograph taken in 1965.
Source: U.S. Army Photograph, Public Affairs Office, White Sands
Missile Range.

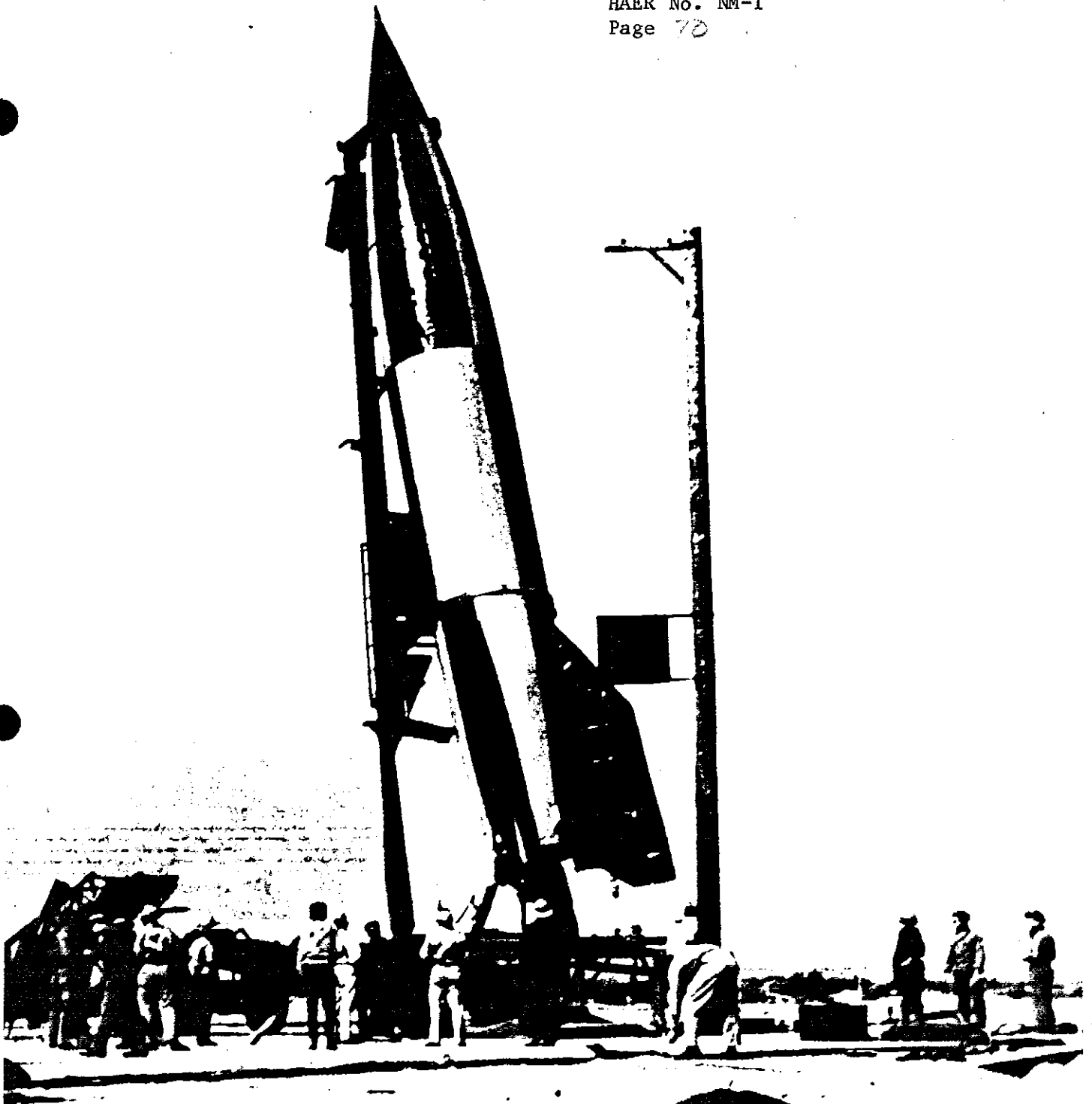


ILLUSTRATION 32 V-2 rocket test firing c. 1946. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

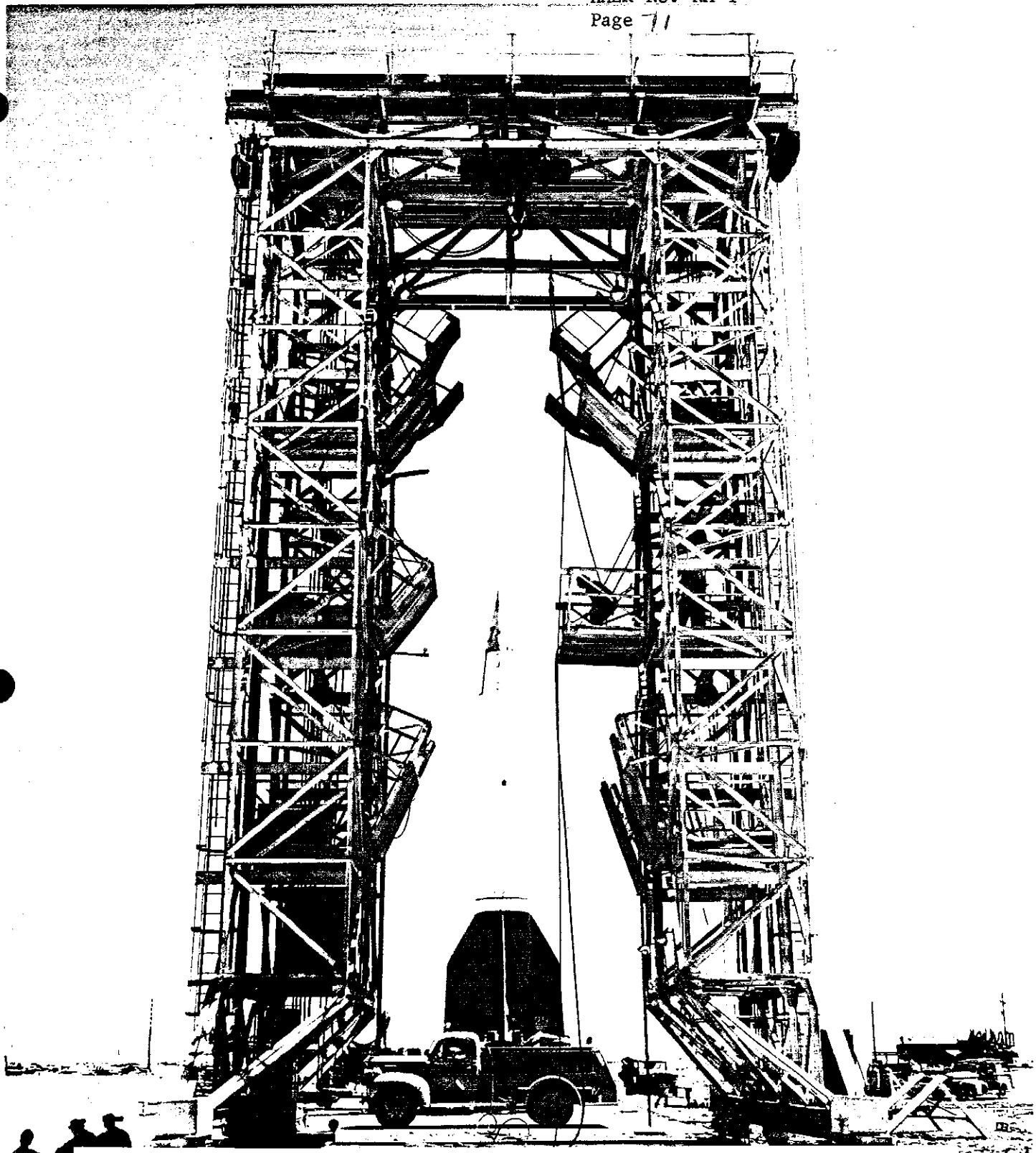


ILLUSTRATION 33 Gantry crane with V-2 rocket No. 25 "Hangar Queen", c. 1947. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

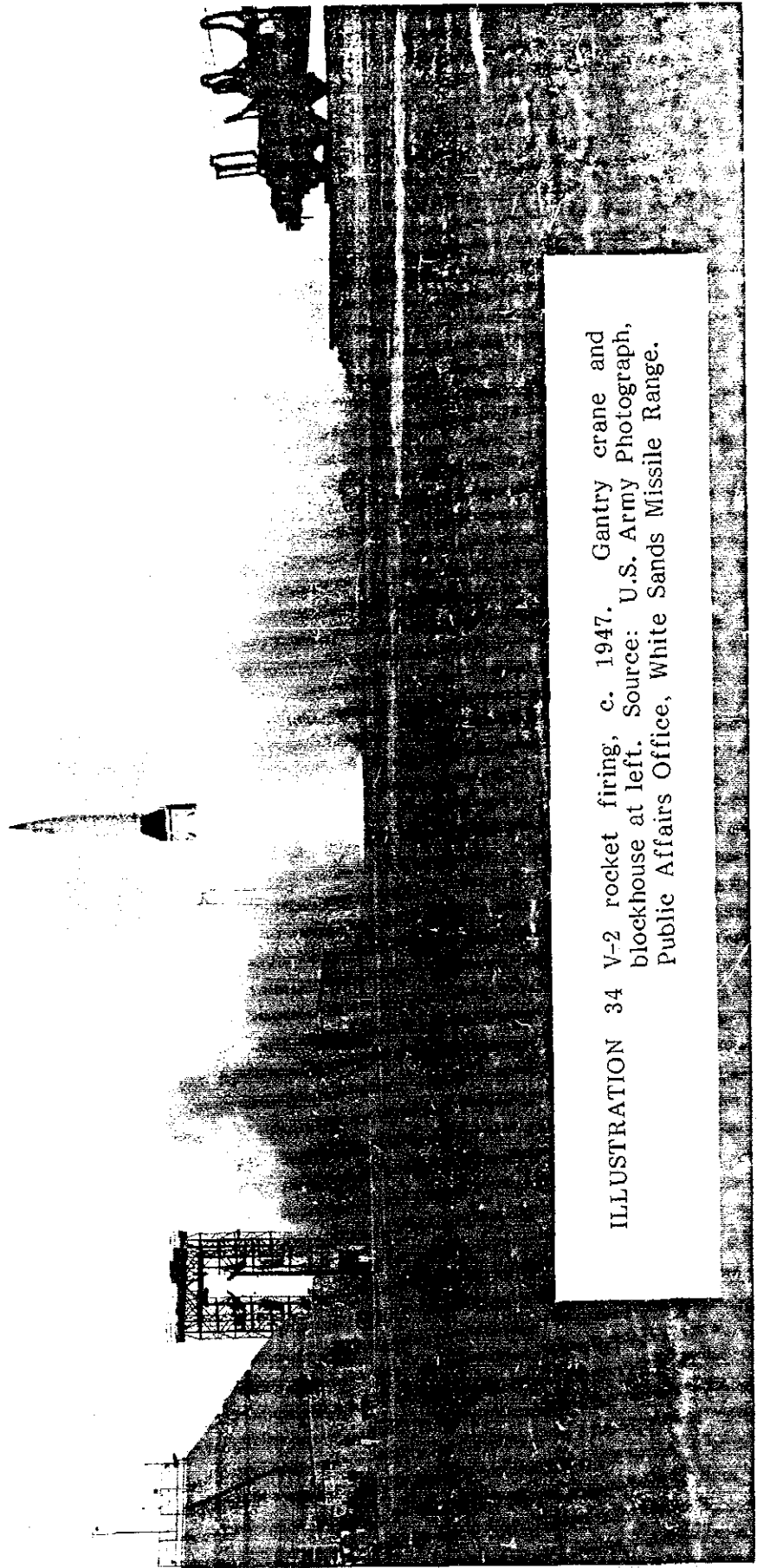


ILLUSTRATION 34 V-2 rocket firing, c. 1947. Gantry crane and blockhouse at left. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

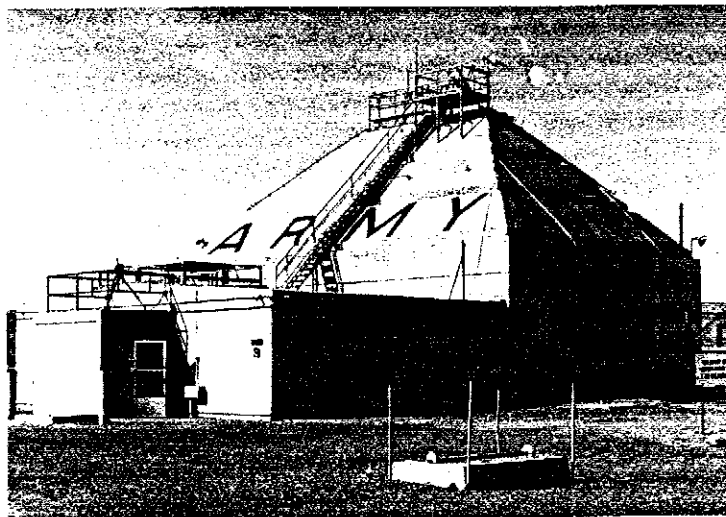
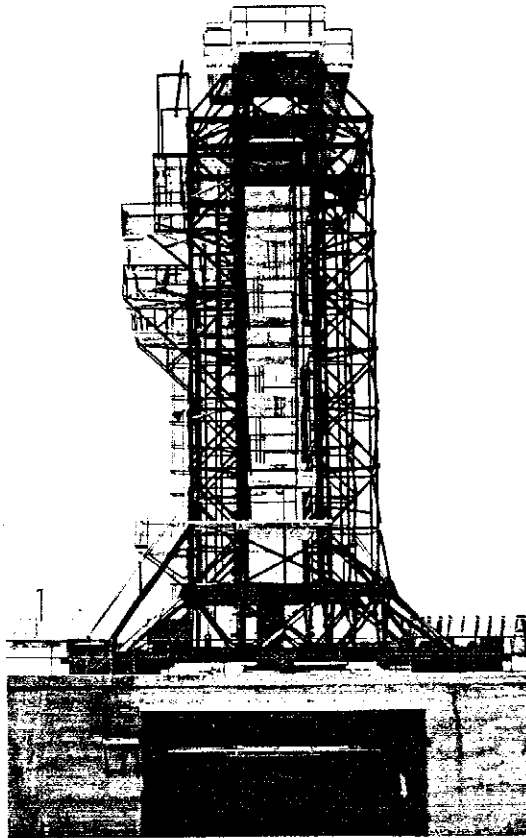


ILLUSTRATION 35

Army blockhouse and V-2 gantry crane today. Source:
Field inventory photographs, 1983, David G. Buchanan,
Building Technology, Inc.

blockhouse (Building 23240), finished in 1947, is similar to the Army's, but slightly smaller. The Navy's U.S.S. Desert Ship facility (Building 23270) was constructed in 1953 as a control center and radar building with instrumentation capable of simulating sea-like conditions for various missile tests. The Navy blockhouse and the Desert Ship are still in active use by the Navy.²⁶

(Illustration 36)

Other early launch facilities in the South Launch Area include Launch Complex 32, containing the Sergeant Missile (1958) and Hawk Missile (1959) facilities; Launch Complex 36, including the Little Joe II complex (1958 - 1968); and Launch Complex 38, originally constructed in 1959 as the assembly and launch area for the Nike-Zeus missile.²⁷

In addition to the early launch facilities, several stands were built to static test rocket motors. The first was constructed early in 1946 for testing a V-2 rocket motor. The initial test took place on March 15, when a V-2 motor was fired continuously for 57 seconds. The successful test led to later aerial firings of the V-2 rocket.²⁸

This early static test stand, known as the 100,000 Pound (100K) Rocket Static Test Facility (Building 19300), was designed for testing liquid propellant propulsion units with a capacity of 100,000 pounds thrust. Located in the southwest corner of the installation, it consisted of a reinforced concrete flame pit and a 50 foot steel tower. During tests, a rocket engine was vertically mounted on the tower and fired; flames from the rocket engine were quenched by 900 gallons of water per minute supplied from a storage tank above the site. A blockhouse with 18-inch concrete walls contained the

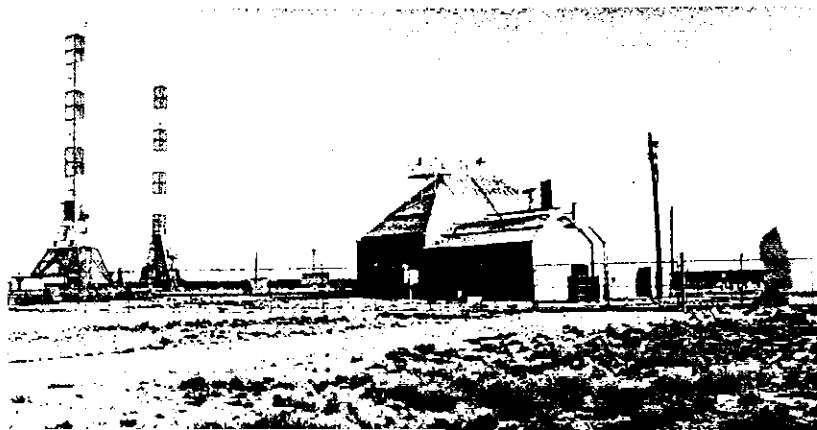


ILLUSTRATION 36 Navy blockhouse and launch towers, and U.S.S. Desert Ship. The launch towers date from 1946 and the blockhouse from 1947. The Desert Ship facility was built in 1953 and can simulate sea-like conditions for various missile tests. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.

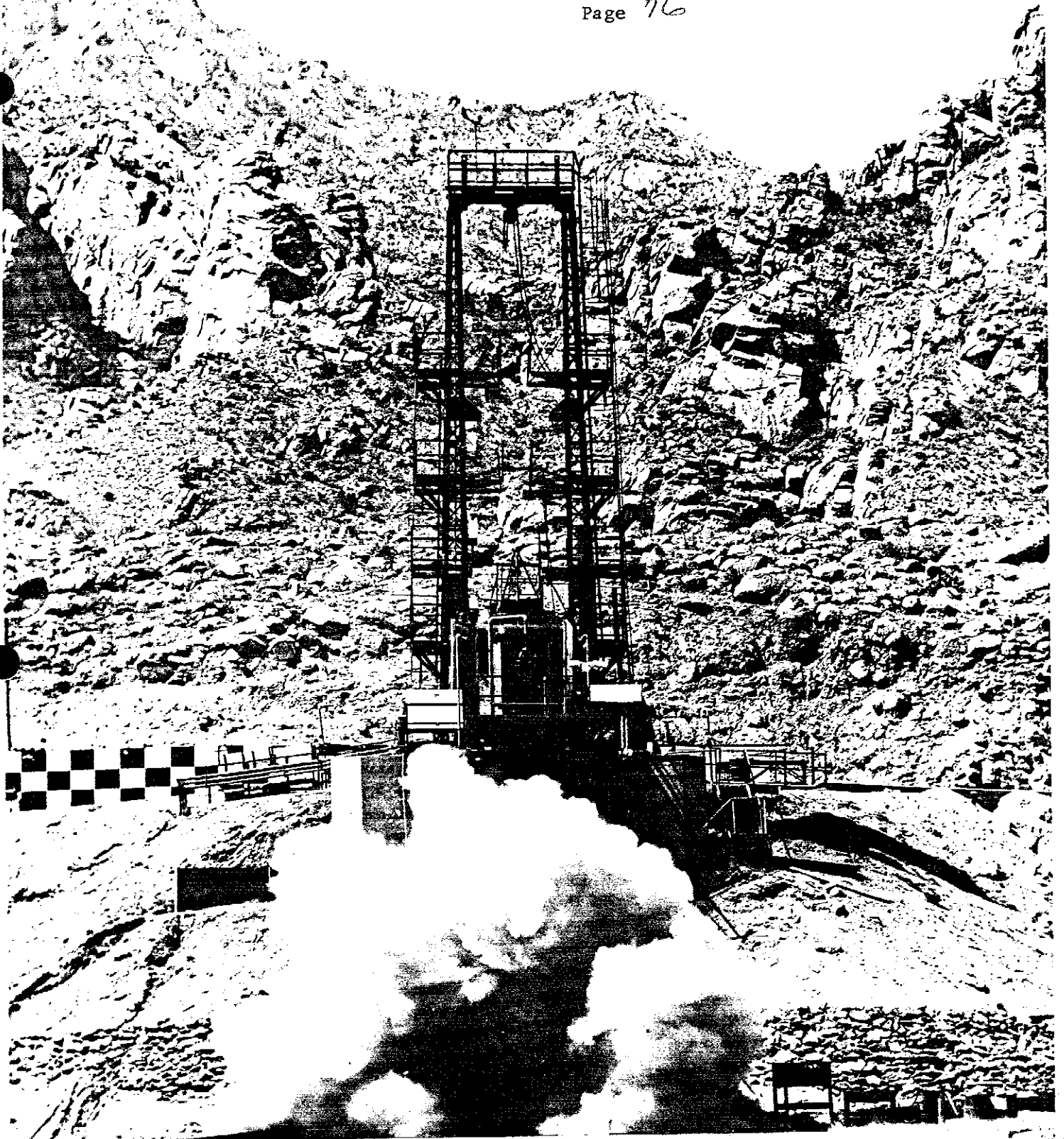


ILLUSTRATION 37 100,000 Pound Static Test Stand in operation; no date was given for the photograph. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

observation and instrumentation space. Instrumentation on 86 channels provided data on such parameters as temperature, pressure, vibration, and acceleration.²⁹
(Illustration 37)

The 100K facility served the V-2 rocket program from 1946 to 1949. In 1951, it was modified for firing the CORPORAL missile, and in 1956 an outrigger engine mount was added as part of the CORPORAL tests. The facility is now abandoned. Its blockhouse and the concrete flame pit remain, but the steel tower has been dismantled and all instruments removed.³⁰
(Illustration 38)

In 1947, the planning and design of a larger static test stand was begun for firing liquid propellant rocket motors for extended durations with up to 500,000 pounds of thrust. Construction of the 500,000 Pound (500K) Rocket Static Test Facility (Building 19241) was begun in 1948 and completed in 1950. This test stand included two liquid fuel tanks (each with a concrete barrier), two pump houses, an underground control room, a steel frame engine mount, and a concrete flame pit lined with steel plates. During tests, the flames from a rocket engine were diverted into this pit and quenched by 3000 gallons of water per minute supplied from a nearby storage tank.³¹ (Illustration 39)

In 1951, the test stand was altered and the engine mounting, originally a 60 degree mount, was replaced by a steel frame tower 60 feet high that held the test engine in a vertical position. The maximum thrust capacity of the facility was reduced from 500,000 to 125,000 pounds.³²

The 500K facility was the largest test stand constructed at White Sands. In 1950 and 1951 it was used in a series of long duration tests with V-2 rockets. After a modification in 1951, the test stand was used for acceptance firings

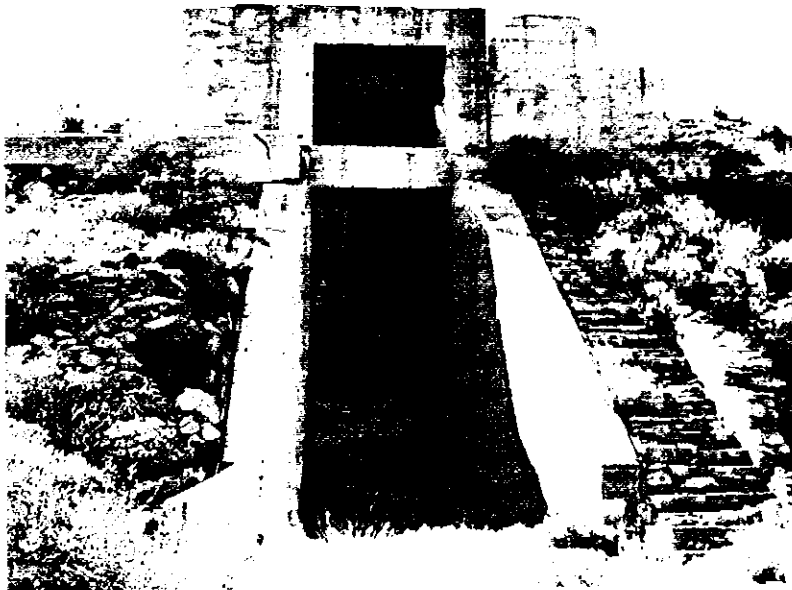
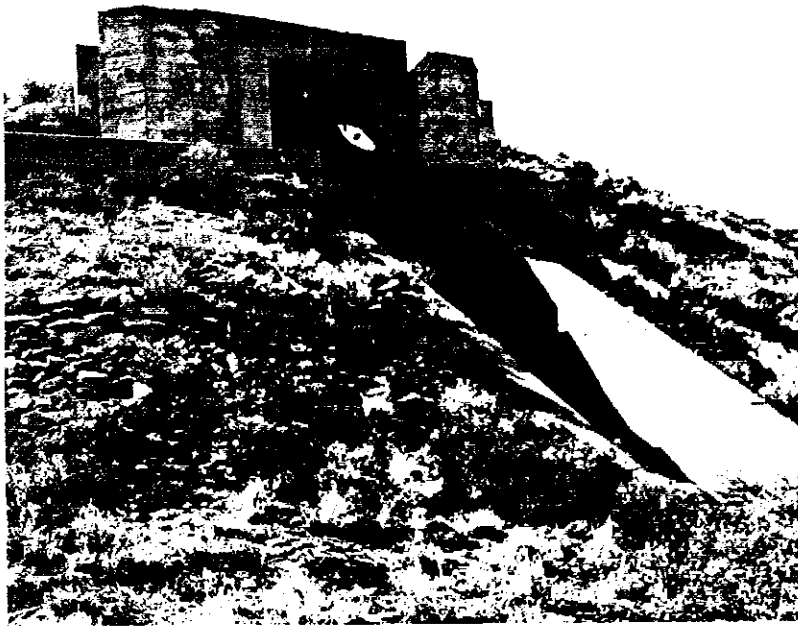


ILLUSTRATION 38 100,000 Pound Static Test Stand today. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.

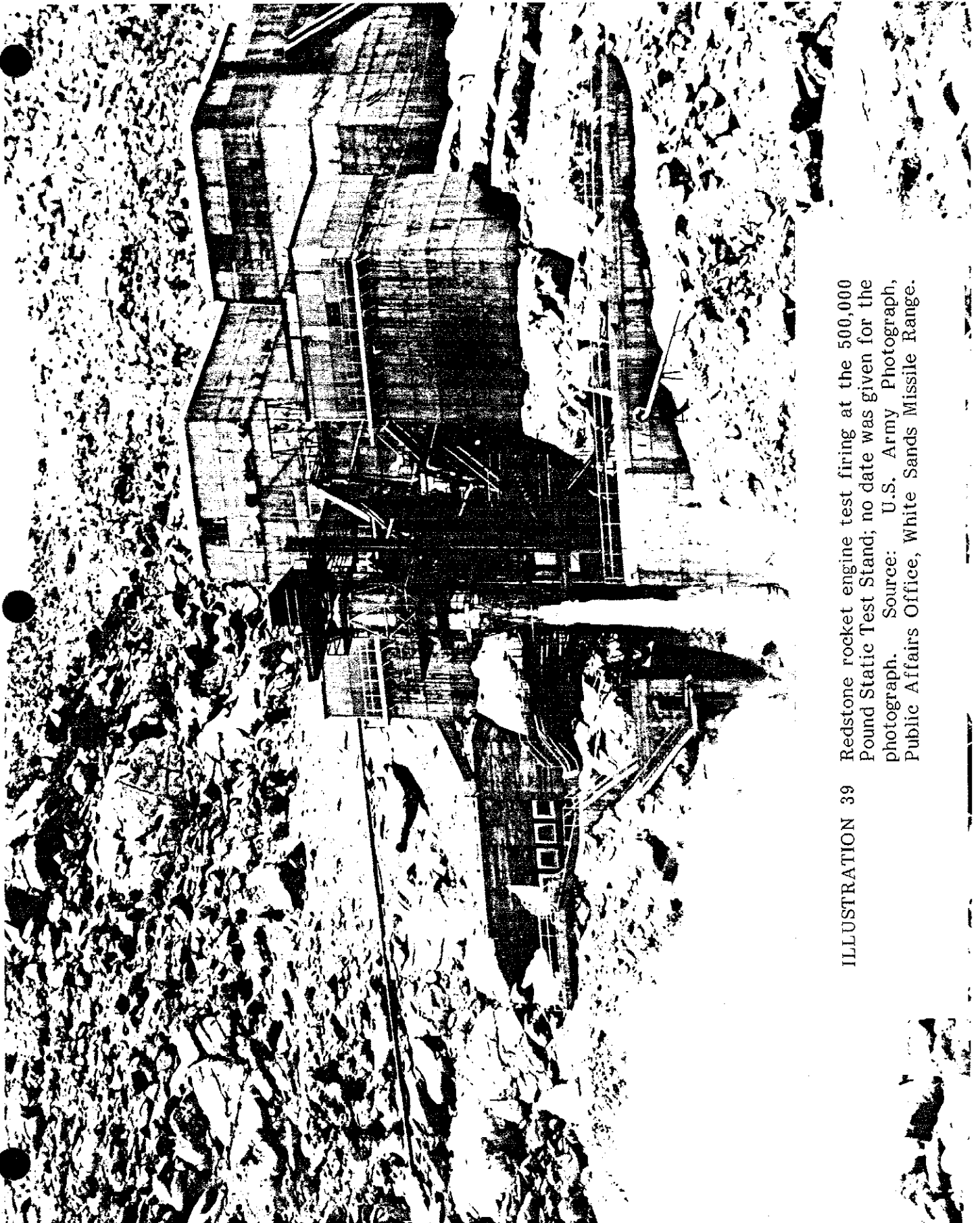


ILLUSTRATION 39 Redstone rocket engine test firing at the 500,000 Pound Static Test Stand; no date was given for the photograph. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

of the Redstone missile power plant, and after 1956, for test firings of the Nike Ajax and Nike Hercules missile systems. It is presently abandoned and stands in a deteriorated state. Although the basic structure is intact, its instrumentation and fuel storage tanks have been removed. A concrete observation bunker, located just west of the test stand, still remains in good condition.³³ (Illustration 40)

A third major static test stand was completed in early 1954: the 300,000 Pound (300K) Solid Propellant Test Facility (Building 19468). It consisted of four concrete test bays, an open test pad, and an observation bunker. Two test bays accommodated a thrust of 300,000 pounds, and two were rated for 5,000 pounds thrust. This facility has since been modified to conduct motor vibration and other tests, and no longer reflects its original use.³⁴

An important component of even the earliest tests at White Sands was the collection of data on the flight performance and characteristics of rockets and missiles. In 1946, the first instrumentation site, "A" Station, was established one mile south of the Army blockhouse. Two instrument trucks and ten men from the Signal Corps Engineering Laboratories at Fort Monmouth, New Jersey, were stationed at White Sands to provide communications equipment for the range. The first missile they successfully tracked was a V-2 rocket fired on April 16, 1946.³⁵

Because of its proximity to the launch site, tracking from "A" Station proved difficult, and its equipment was moved to a new site, "C" Station, about 3 miles south of the Army blockhouse. "C" Station served as the first permanent

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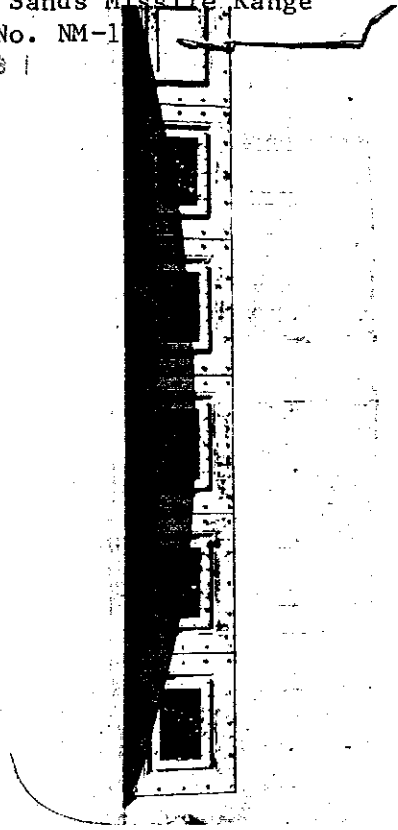
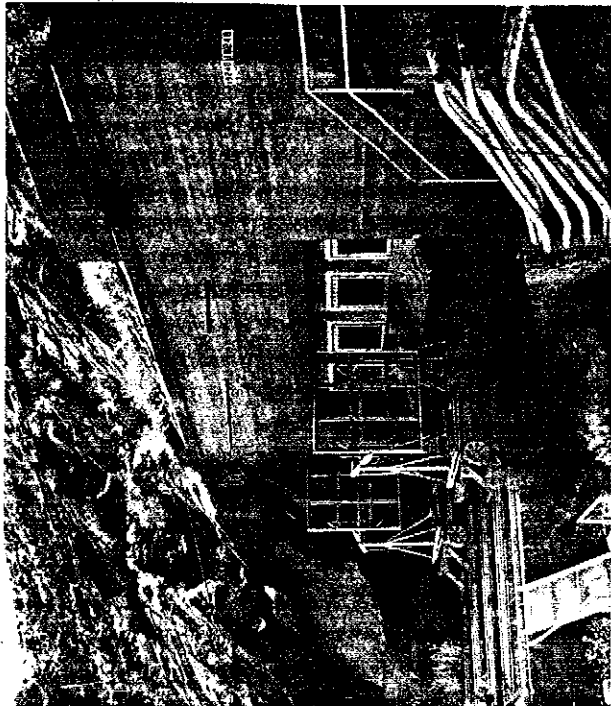
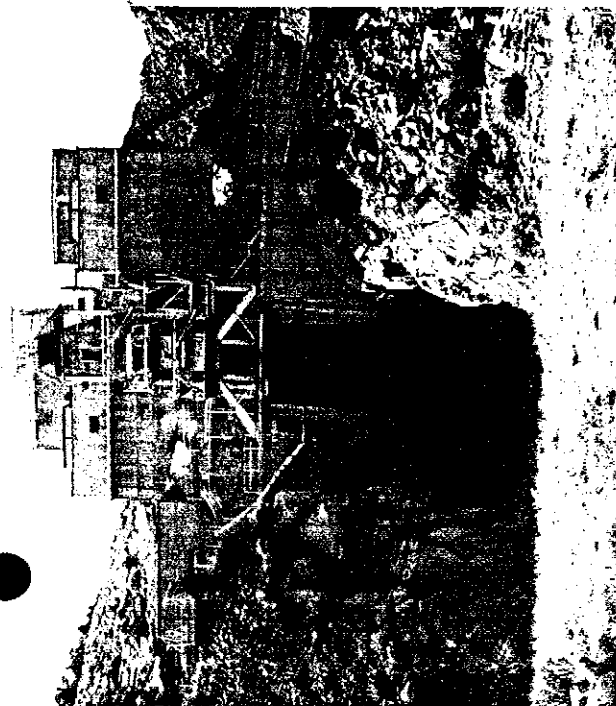
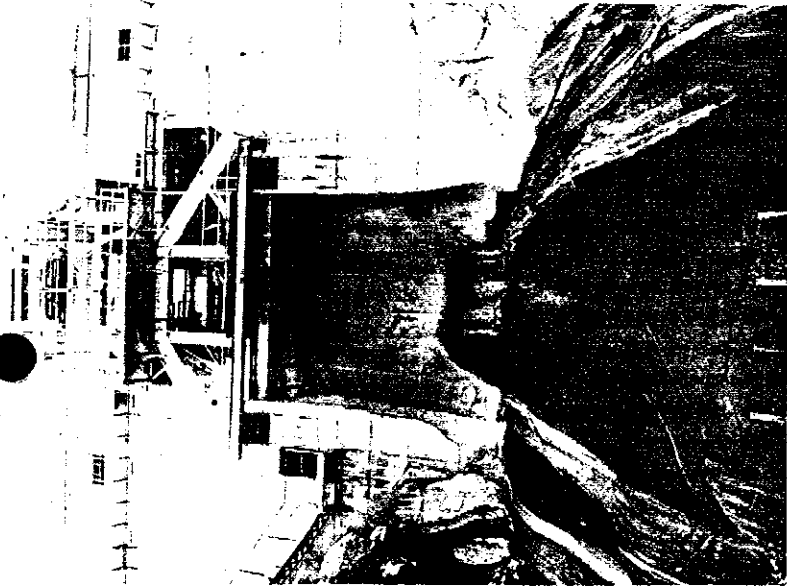
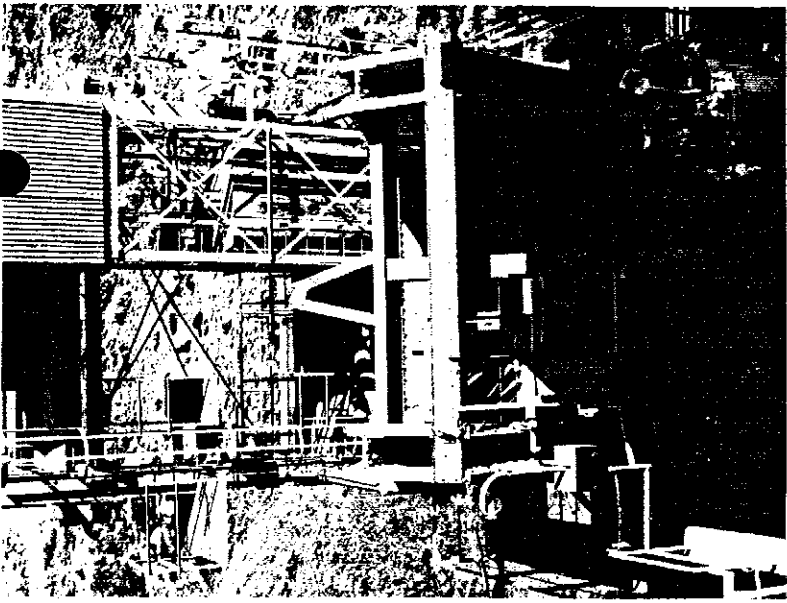


ILLUSTRATION 40 500,000 Pound Static Test Stand today. Block-house shown at right. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.

control center, combining all missile control and tracking facilities in one area. The site still serves as a control center. The present two story concrete block structure (Building 21925) dates from 1959. Three FPS-16 Radar sets, also dating from 1959, provided information about range safety control and aided in-flight tests.³⁶

The missile range now has more than 1,000 precisely surveyed instrumentation sites and over 700 optical and electronic instrument buildings.³⁷ Optical measuring systems include tracking telescopes and terminal telescopes, non-tracking fixed cameras, and cinetheodolites. Cinetheodolites produce filmed records of missile tests that provide information about location, acceleration, and missile flight performance. Telemetry and other electronic measuring systems, including fixed and mobile radar units, provide data on internal conditions and performance of the rocket's engine during testing.³⁸

(Illustration 41)

In 1951, the Small Missile Range was established just north of U.S. Highway 70. This one by ten mile test range has launch facilities and fixed camera instrument buildings. Launch facilities, missile assembly warehouses, and storage buildings are located in the southern end of the site. A flight control building (Building 27170), constructed in 1953, houses an observation tower and instrument rooms. Bowen-Knapp Camera Stations are evenly spaced in parallel rows on both sides of the range to record flight performance. The Small Missile Range was first used to test the LOKI missile, test-fired at White Sands from 1951 to 1955. The site still tests hand-held and mobile launch missiles.³⁹

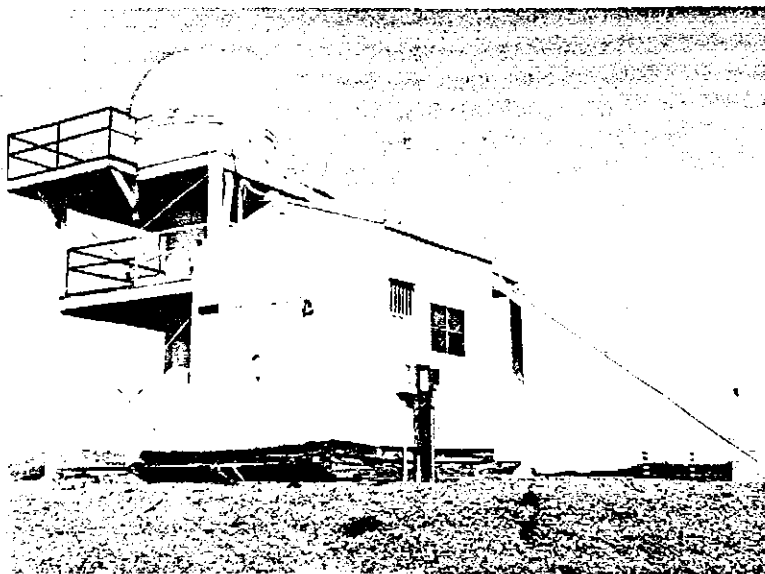
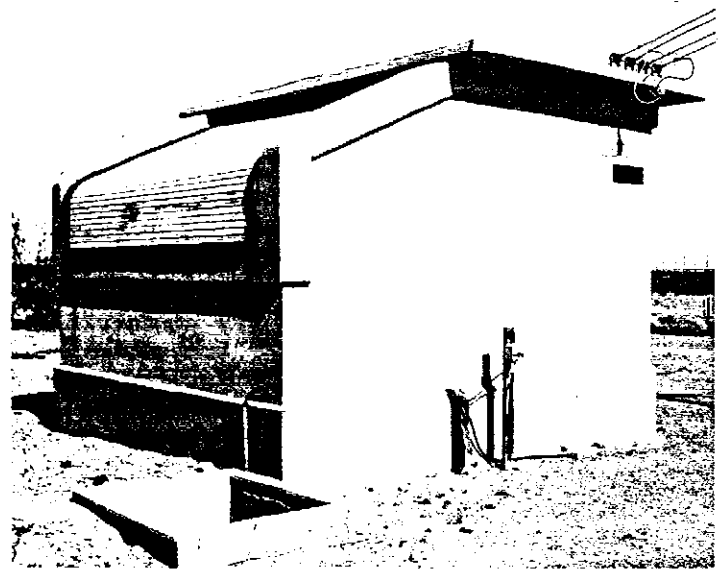
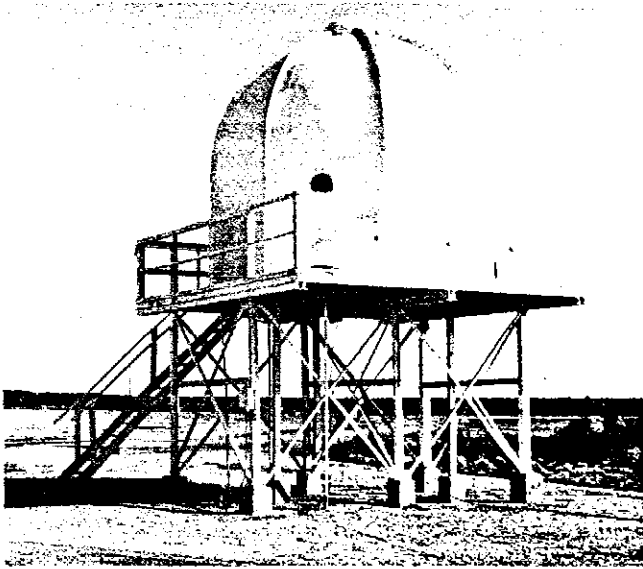


ILLUSTRATION 41 Instrumentation sites at White Sands. There are over 1,000 precisely surveyed instrumentation sites and more than 700 optical and electronic instrument buildings on the range, of which these are examples. Above left, radome (1954) on elevated platform. Above right, Bowen-Knapp camera station (1952). Below, cinetheodolite (1961) on elevated platform. Source: Field inventory photographs, 1983, David G. Buchanan, Building Technology, Inc.

After completion of the first permanent launch and test facilities in 1945 and 1946, contracts were let for larger, semi-permanent buildings in the main post area. One- and two-story 800 series wood buildings were constructed to serve as administrative buildings, barracks, mess halls, recreational facilities, and laboratories. Some still remain; Buildings 108, 109, 118, and 119, for example, were constructed in 1947 as barracks and are now used as administrative buildings.⁴⁰ (Illustration 42)

In the spring of 1946, construction began on a Naval cantonment adjacent to the Army cantonment area. Several structures remain, including six quonset huts (Buildings 418-421, 442, and 446) originally built to provide additional housing for Navy enlisted personnel. Three quonset huts built in 1947 as shop buildings (Buildings 1472, 1473, and 1475) also remain.⁴¹

Between 1946 and 1956, the main post area assumed the general appearance it has today. Major permanent construction included a headquarters building (Building 100), completed in 1951; a major administration building (Building 1530) also completed in 1951 and used today as the National Range Headquarters; a laboratory (Building 1512), completed in 1954; and a fire station (Building 155), completed in 1950. These masonry structures are located in the administration and troop area and the technical area of the main post. Five major missile assembly buildings (Buildings 1540, 1544, 1550, 1554 and 1558) were also built in the technical area between 1946 and 1955. These large steel warehouse structures accommodated the expanded number of missile tests conducted during this period. Various small warehouses and shops and a maintenance facility (Building 1790) were built in 1948.

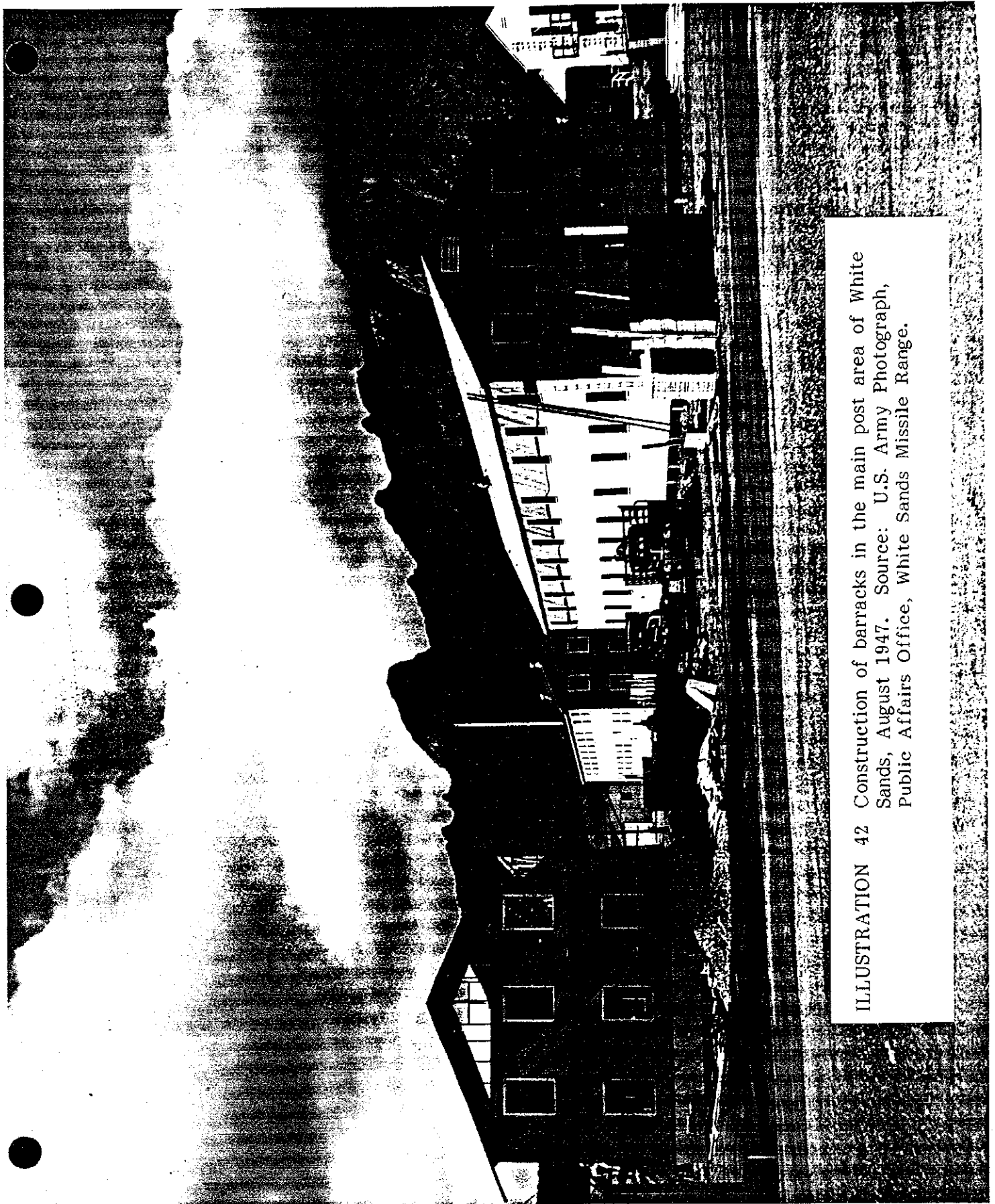


ILLUSTRATION 42 Construction of barracks in the main post area of White Sands, August 1947. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

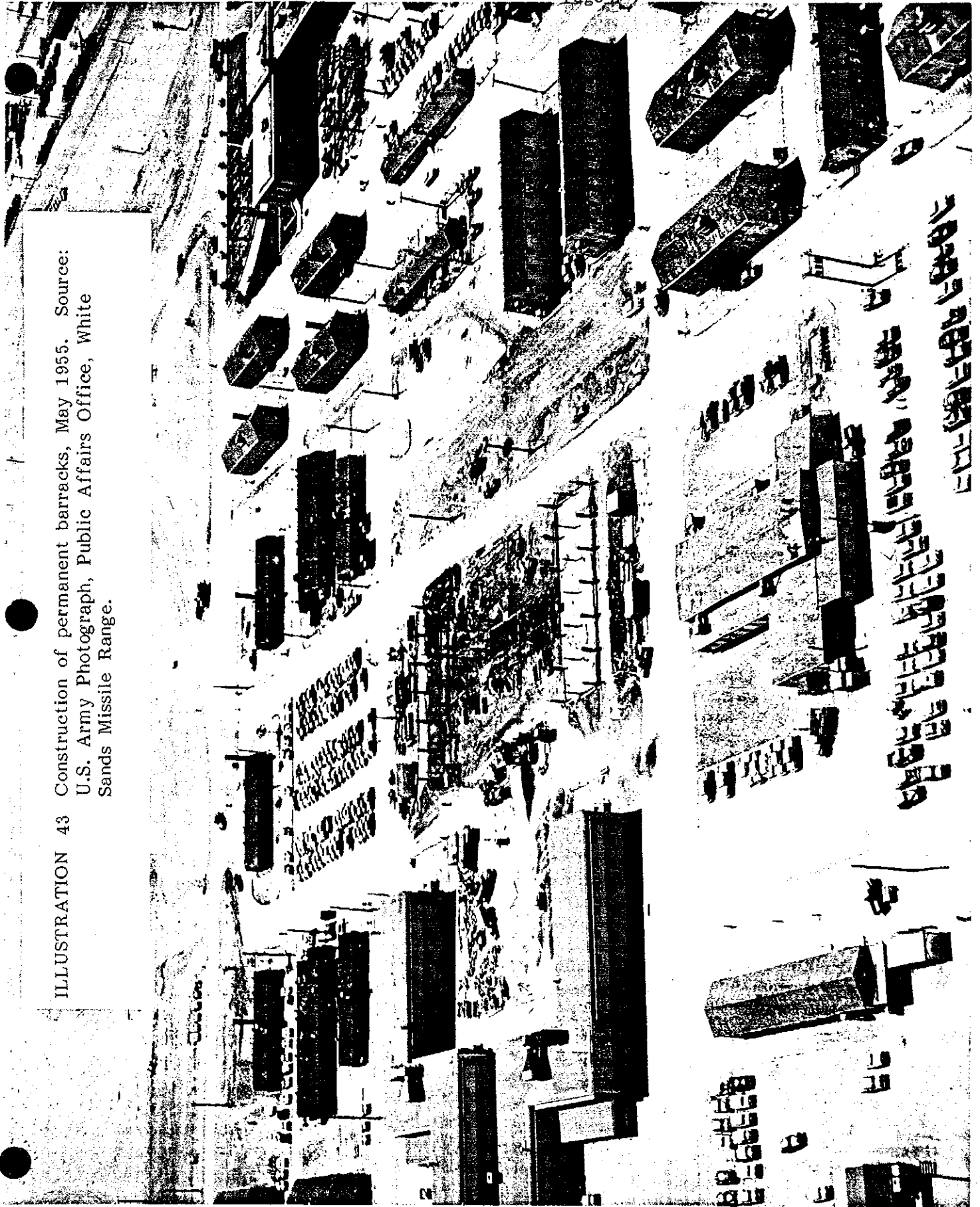
Construction focussed on housing and community facilities between 1946 and 1956. The Army and the Navy housing areas went up on the western edge of the main post, separated from the administration and technical areas. One- and two-family houses were planned on an irregular street grid. These dwellings, built of concrete block with a stucco finish, provided permanent housing for 430 families. Between 1953 and 1956, three permanent barracks (Buildings 128, 129 and 143), an elementary school, a commissary, and a cafeteria were also built, as well as a branch U.S. Post Office, a bank, and a post exchange. (Illustration 43)

Since 1956, many of the wood cantonment buildings in the main post area have been demolished. New construction has included two permanent barracks and a mess hall (Buildings 124, 126 and 160), built in 1959; a number of warehouses and fabrication shops; additional housing units erected between 1958 and 1961; and additional community facilities, including a chapel (Building 265), completed in 1961, a new post exchange (Building 260), a health clinic (Building 530), and a number of recreational facilities.

Missile Park, a triangular shaped site at the intersection of Headquarters and Nike Avenues in the main post area, has served as an outdoor missile museum since 1955. The park features examples or models of the many Army, Navy, and Air Force missiles and rockets tested at the range. The missiles are displayed in typical firing attitude.

The first three missiles installed at Missile Park were the German V-2, the American version of the German V-1 (known as the Loon), and the U.S.

ILLUSTRATION 43 Construction of permanent barracks, May 1955. Source:
U.S. Army Photograph, Public Affairs Office, White
Sands Missile Range.



Army's Nike 1, later known as the Nike-Ajax. The remaining missiles have been donated by the private contractors that developed and built them.⁴³ (Illustration 44)

Four major up-range communication and instrumentation centers were established beginning in the early 1950's. These areas provide technical and support facilities for the range. Virtually all the range center buildings are simple wood or cinderblock buildings.⁴²

Rhodes Canyon Range Center, located mid-range, is a permanent operational area that provides communications and maintenance support. A communications repeater building (Building 30724) was built here in 1952. Other major facilities include a carpenter shop (Building 30780), built in 1953; an instrumentation building (Building 30728), built in 1955; a telephone exchange building (Building 30726), built in 1957; several maintenance and storage facilities; and a 20-man crew shelter with mess (Building 30740), built in 1960.

Stallion Range Center, headquarters for north range operations, is located near the northwest corner of White Sands, 104 miles north of the main post area. The Army built a generator building (Building 34182), an instrumentation building (Building 34181), and a cinetheodolite building (Building 34183) in 1953. The center also includes a 40-man barracks (Building 34215), built in 1955, and four 40-man crew shelters (Buildings 34218, 34224, 34226, and 34228), built in 1960.

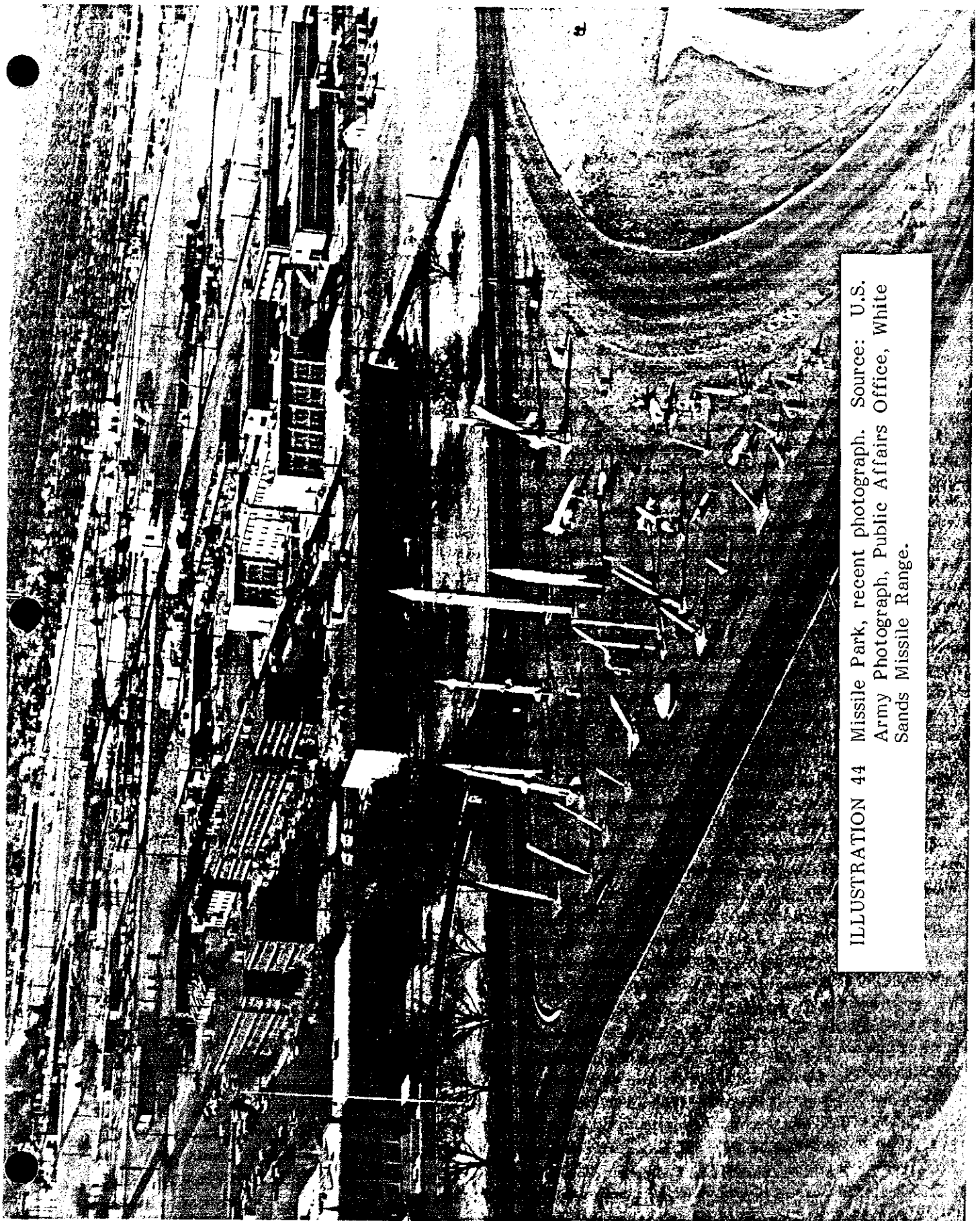


ILLUSTRATION 44 Missile Park, recent photograph. Source: U.S. Army Photograph, Public Affairs Office, White Sands Missile Range.

Oscura Range Center, located in the northeast corner of the mid-range area, provides technical support and serves as a temporary base for missiles fired downrange. The center includes an instrument building (Building 31766), built in 1953, and a 40-man barracks (Building 31725), built in 1956.

North Oscura Range Center consists of four separate areas, located 4 miles apart, atop the Oscura Mountains in the northeast corner of the Range. No longer functioning as a support area, it is used today mainly for missile tracking instrumentation and communications for north range tests. There are several instrumentation buildings: Building 33200, built in 1952; Building 33152, built in 1953; Building 33153, built in 1954; and a communications building (Building 33170), built in 1955. A 40-man crew shelter (Building 33130) was built in 1953.

HOLLOMAN AIR FORCE BASE SUPPLEMENTAL AREA

The Holloman Air Force Base Supplemental Area contains the Holloman Test Track, an aerospace ground test facility used to simulate flight conditions under a closely controlled environment. The track provides a link between laboratory investigations and full-scale flight tests. Specially designed test vehicles, powered by either liquid or solid propellant rocket engines, are accelerated along the test track at speeds of up to 7,000 feet per second (Mach 6) to measure the performance of a wide variety of items at high speeds or under great acceleration or deceleration stresses.⁴⁴

(Illustrations 45 and 46)

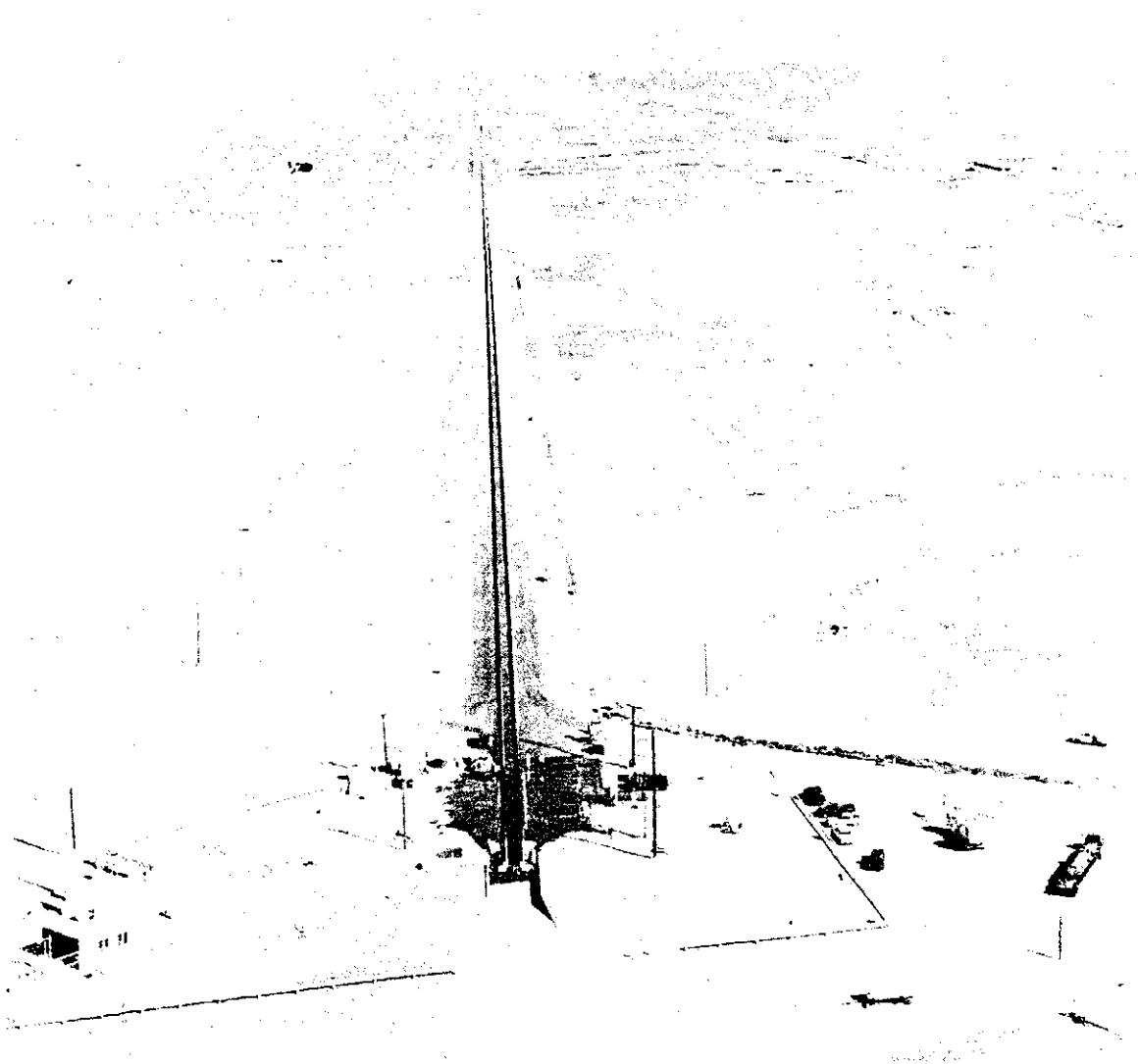
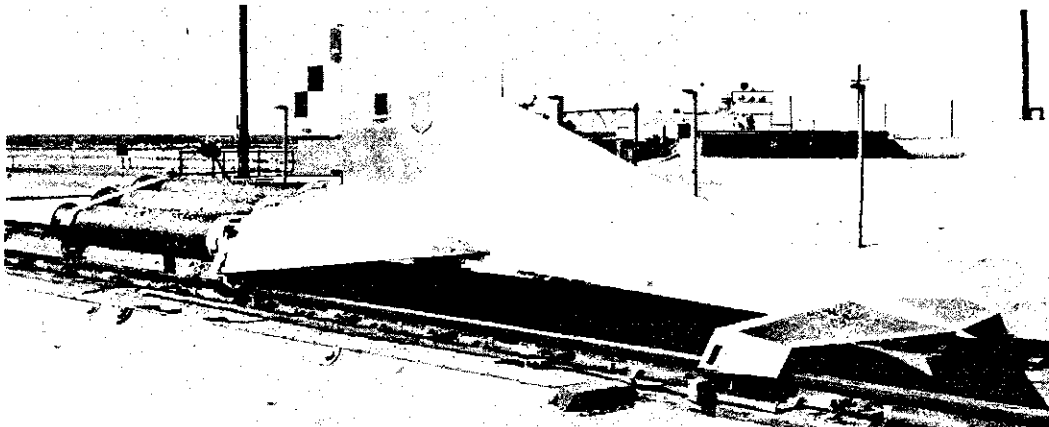
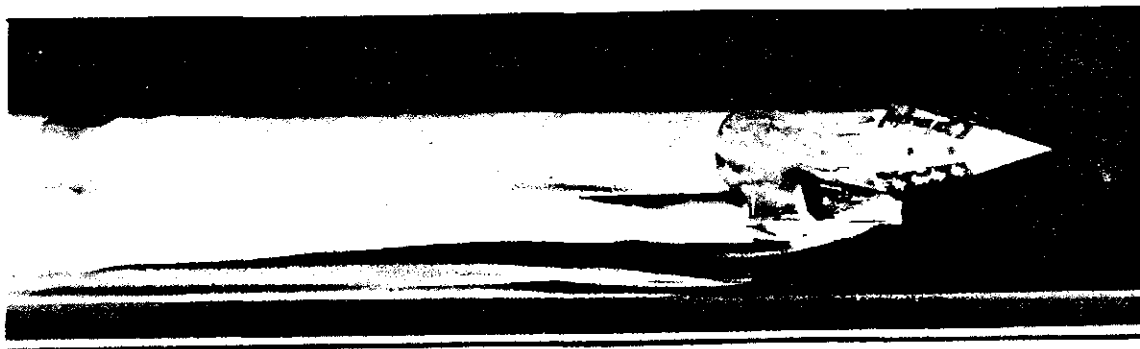


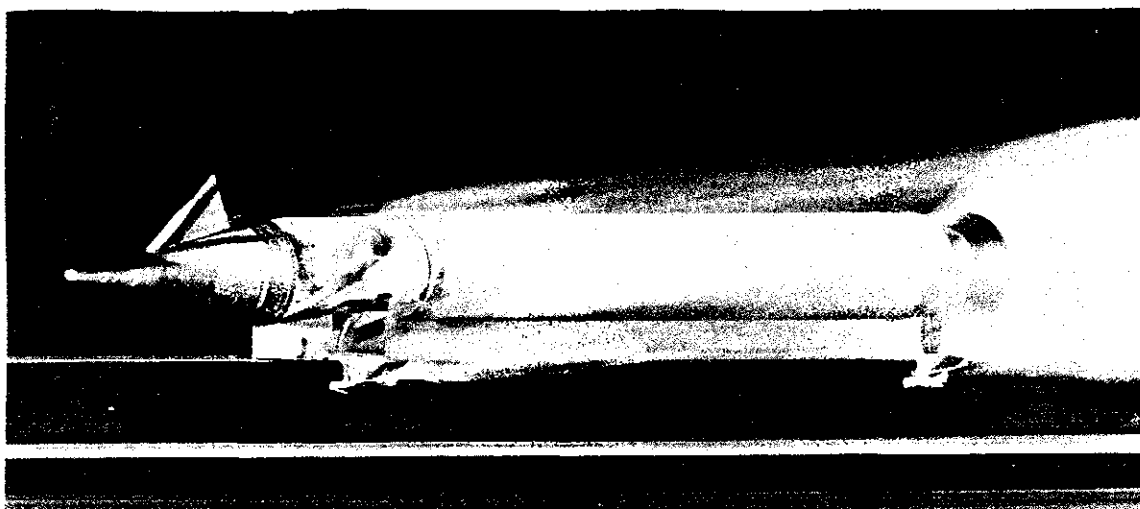
ILLUSTRATION 45 An aerial view of the Holloman Test Track, looking north; no date given for the photograph. Source: The Holloman Track, Armament Division, Holloman Air Force Base, New Mexico, 1974.



Typical example of a test sled.



A monorail sled during a high speed erosion test.



A typical monorail sled at high speed.

Source: The Holloman Track, Armament Division, Holloman Air Force Base,
New Mexico, 1974.

The track was designed in 1950 as a test facility for the Snark missile. Originally 3,500 feet long, it was extended in 1956-57 to 35,000 feet to accommodate a greater range of missile tests. An additional 5,588 feet of track was laid in 1966, and the last addition in 1972 expanded the track to 50,788 linear feet, just under 10 miles.⁴⁵

The track is constructed of heavy duty crane rails supported on a continuous reinforced concrete girder. Most of the track is a two-rail design, although the final 15,200 foot extension incorporates a third rail for special three-track test sleds. The tracks are precisely aligned to assure a high degree of straightness and surface smoothness.⁴⁶

The test facility also includes four blockhouses, a centrally located telemetry station, a multiplicity of instrumentation sites, and shop buildings for rocket sled fabrication and preparation. The blockhouses are used as control buildings to launch sleds from different positions along the track, and the telemetry station (known as the Midway Building) serves as the central facility for telemetry and data recording.⁴⁷ (Illustration 47)

Major electronic data systems at the test track record information about sled position, velocity, and acceleration. Optical instrumentation is also widely used. Special cameras having two major optical systems are employed for recording high speed tests. The first is a metric optical instrument that photographs the test sled in relation to precisely surveyed sites. The acceleration and velocity of a sled can be computed from this photographic data. The second system is Image Motion Compensation (IMC) photography, which provides a detailed view of a test object as it passes a given point on the

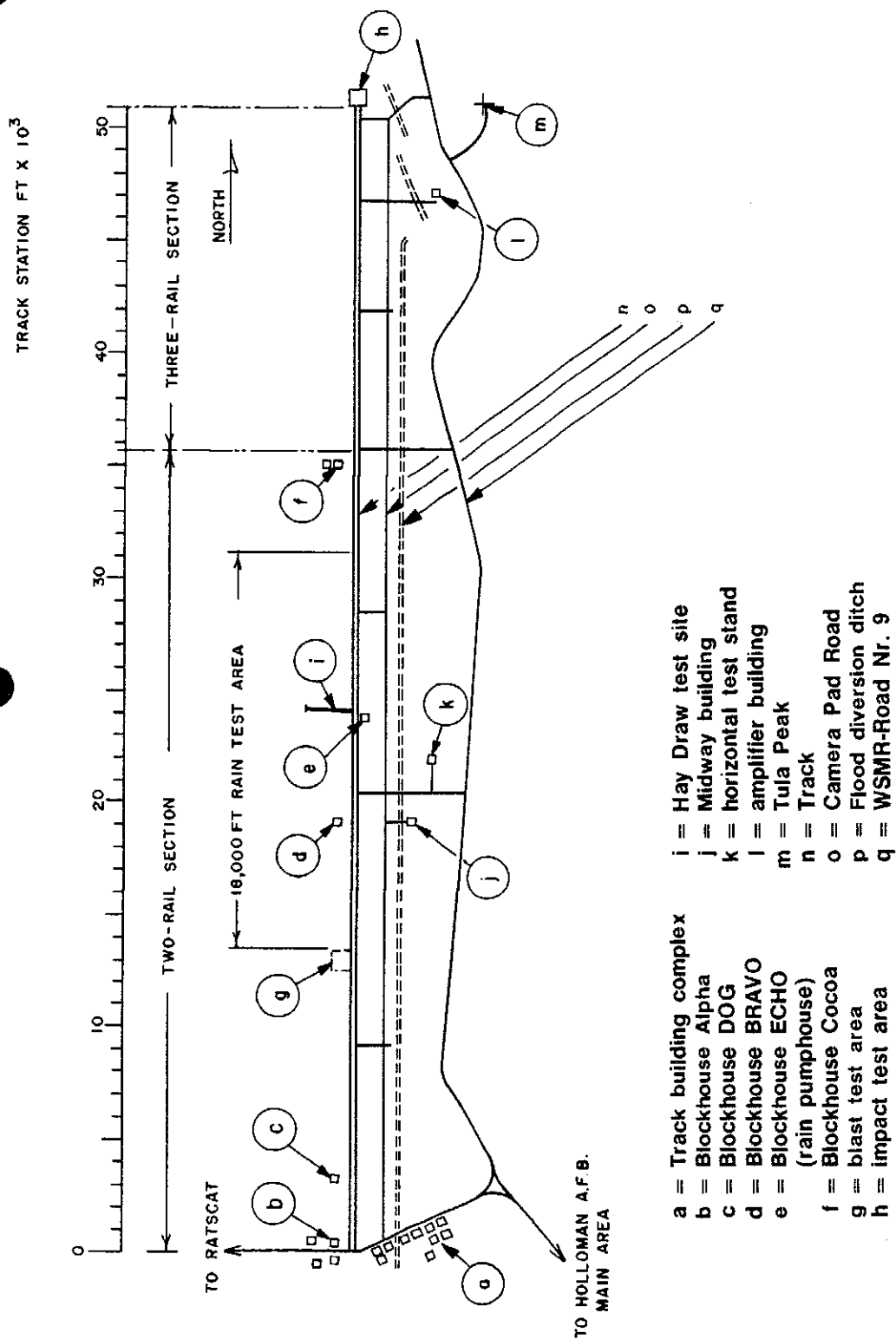


ILLUSTRATION 47 Site plan of the Holloman Test Track, showing buildings and other sites associated with the track. Source: The Holloman Track, Armament Division, Holloman Air Force Base, New Mexico, 1974.

track. Traditional motion picture coverage is also provided during rocket tests.⁴⁸ (Illustration 48)

The Holloman Test Track performs a wide variety of tests. It frequently tests aircraft ejection seats at operational speeds that closely simulate flight conditions. Environmental tests are also frequently performed at the Holloman track: rain, hail, and dust are ingeniously simulated by special machines to test a missile or warhead's ability to withstand various climatic or atmospheric conditions. The Holloman Test Track also does aerodynamic, re-entry, and impact testing for both military and civilian users.⁴⁹

(Illustration 49)

UTAH LAUNCH COMPLEX

The Utah Launch Complex is a subinstallation of White Sands Missile Range located in eastern Utah approximately two miles east of the town of Green River. It is sited on mostly barren land and consists of 6,309 acres of exclusive use and 11,872 acres of co-use property. There are no pre-military structures on the site. Prior to becoming inactive in 1979, it functioned as an off-range missile test facility for Air Force and Army missile programs. The Air Force established Green River in 1962 as a remote missile launch site for the ABRES (Advanced Ballistic Re-entry System) program, and from February, 1964, to August, 1973, Athena rockets were launched from Green River to targets 450 miles away at White Sands.⁵⁰ In 1971, the Army relocated its Pershing missile launch site to Green River from Gilson Butte.⁵¹

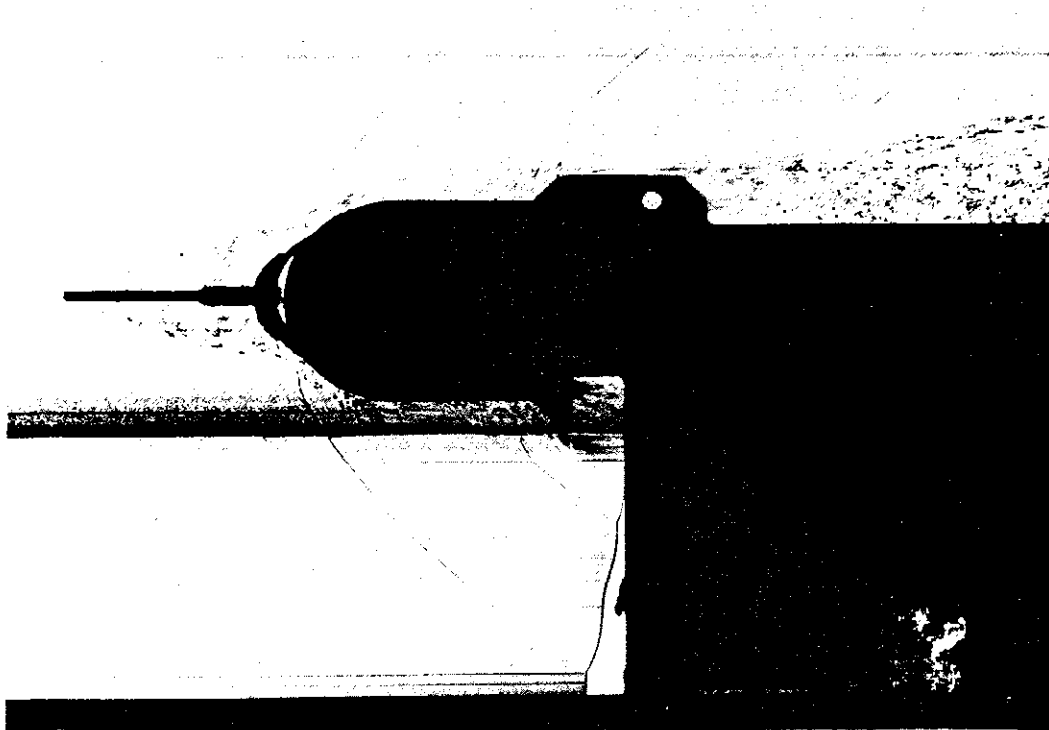


ILLUSTRATION 48 An example of a shadowgraph of a test sled taken at high speed by image motion compensation (IMC) photographic technique. Source: The Holloman Track, Armament Division, Holloman Air Force Base, New Mexico, 1974.

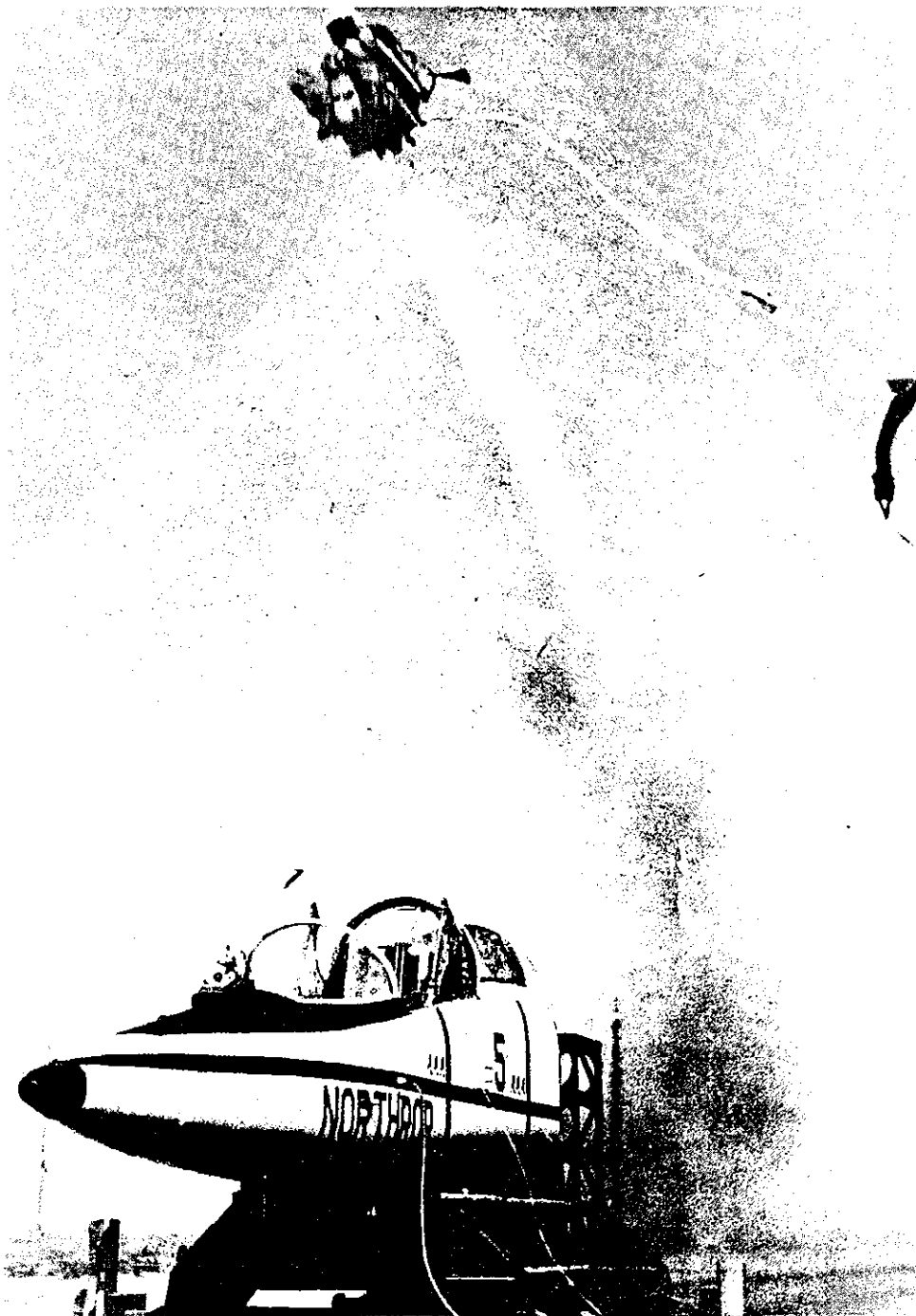


ILLUSTRATION 49 A seat ejection test conducted at the Holloman Test Track. Source: The Holloman Track, Armament Division, Holloman Air Force Base, New Mexico, 1974.

The Utah Launch Complex consists of a headquarters area, the Athena Launch Complex, and the Pershing Launch Complex. The headquarters area, established in 1962, was originally composed of trailers and prefabricated steel buildings that housed offices, maintenance and technical facilities, a telephone exchange, a dining hall, a fire station, and housing for military and civilian workers. The Olson Construction Company of Salt Lake City was the prime contractor. Most of the steel buildings remain, but many of the trailers have been removed.⁵²

The Athena Launch Complex, built in 1963, includes a blockhouse and three launch pads. Launch Pad 1 (Building 50253) and Launch Pad 2 (Building 50291) are covered by a Temperature Controlled Environmental Enclosure (TCEE), a steel building that provides a controlled environment for assembling and preparing missiles for launch. Sited on rails, it can be rolled away from the launcher prior to firing. The TCEE has been removed from Launch Pad 3. Nearby a reinforced concrete blockhouse (Building 50207) houses instruments and launch control equipment. A separate instrumentation site on a mountain ridge near the northern border of the facility tracks missiles after launch. This site includes radar and telemetry systems, optical and frequency monitoring systems, and a meteorological station. The Pershing Launch Complex was established in 1971, but all that remains of this site is an earth, wood, and concrete protective bunker and a concrete launch pad.⁵³ (Illustrations 50 and 51)

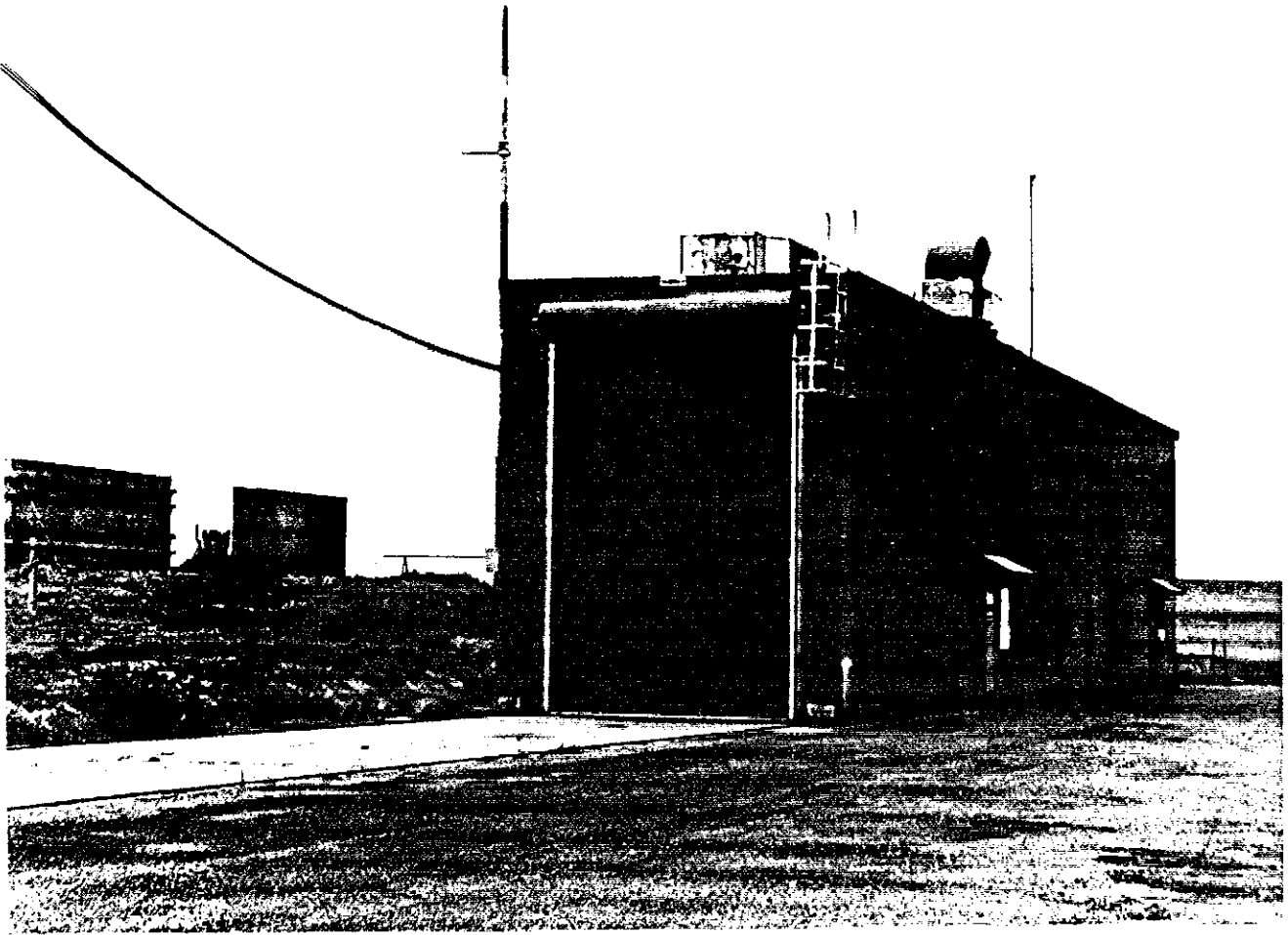


ILLUSTRATION 50 A TCEE (Temperature Controlled Environmental Enclosure) building at the Athena Launch Complex located at the Utah Launch Complex in Green River, Utah. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

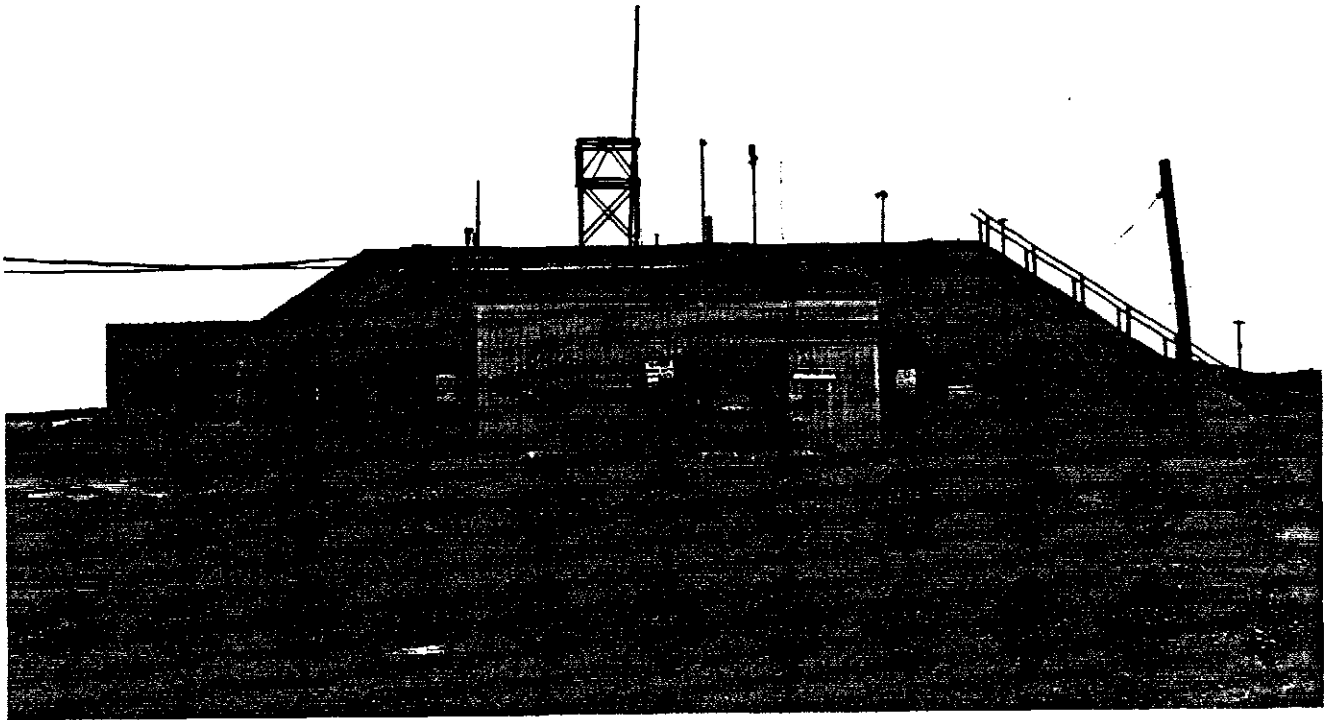


ILLUSTRATION 51 Concrete blockhouse at the Athena Launch Complex located in the Utah Launch Complex at Green River, Utah. Source: Field Inventory Photograph, 1983.

NOTES

1. Public Affairs Office. White Sands History, pp. 47-48; see also Frank J. Malina, "Origins and First Decade of the Jet Propulsion Laboratory," The History of Rocket Technology, pp. 46-66.
2. White Sands History, pp. 49-55.
3. Ibid.
4. Ibid., pp. 55-62.
5. Ibid., pp. 62-96; see also Frederick I. Ordway and Mitchell R. Sharpe, The Rocket Team, pp. 344-362; and E. J. Tangerman, "Nazi Vengeance: The German V-2 Rocket Flies Again at White Sands Proving Ground," Army Ordnance, pp. 153-155; Harvey Riukins, "A Report on the Ordnance Firings at White Sands," Army Ordnance, pp. 429-431; White Sands Missile Range, Fact Sheet, "V-2 Story."
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7. White Sands Missile Range, Fact Sheet, "Extended Range Sites, Utah and Idaho."
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9. White Sands Missile Range, Fact Sheet, "White Sands Missile Range at a Glance," pp. 5-6.
10. Ibid., pp. 6-7; see also White Sands Missile Range, Fact Sheet, "Space Shuttle at White Sands Missile Range."
11. White Sands Missile Range, Fact Sheet, "Historical Background of White Sands Missile Range," pp. 2-3; White Sands Missile Range, Installation Environmental Impact Assessment, p. 31.
12. Paige W. Christiansen, "Dona Ana County, New Mexico: Historic Themes," Guidebook to the Las Cruces Country, pp. 71-73; White Sands Missile Range, Fact Sheet, "Historical Background of White Sands Missile Range," pp. 3-11, 16-21; T. E. Kelly, "The Lost Padre Mine and the Organ Mining District," Guidebook to the Las Cruces Country, pp. 163-165; White Sands Missile Range, Fact Sheet, "Historical Background of White Sands Missile Range," p. 19.
13. Personal interview with Peter Eidenbach, Human Systems Research, Inc., Tularosa, New Mexico, February, 1983; and brochure entitled, "Dividend Mining and Milling Company at Estey City, New Mexico," c. 1905.

14. Peter L. Eidenbach and Mark Whimberly, Archaeological Reconnaissance in White Sands National Monument, see "The Lucero Ranch - Lawman's Retreat," pp. 17-18; see also Janet A. Stewart, Arizona Ranch Houses: Southern Territorial Styles, 1867-1900; and O. E. Meinzer and R. F. Hare, Geology and Water Resources of Tularosa Basin, New Mexico, pp. 118-119.
15. National Register of Historic Places, Trinity Site, Nomination, 1972.
16. Lansing Lamont, Day of Trinity, pp. 235-256; Los Alamos Scientific Laboratory, Los Alamos 1943-1945, The Beginning of an Era, pp. 29-57.
17. Ibid.
18. Ibid.
19. White Sands History, pp. 14-15.
20. Ibid., pp. 16-17.
21. Ibid.
22. Ibid., pp. 20-21.
23. New Mexico State Register of Cultural Properties; White Sands History, p. 22.
24. Ibid.
25. Ibid.
26. Field inventory and White Sands Real Property Inventory.
27. Ibid.
28. Special Report, "100,000 Pound Rocket Static Test Stand," pp. 1-7.
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30. Installation Environmental Impact Assessment, p. 15; field inventory.
31. Special Report, "500,000 Pound Rocket Static Test Stand," pp. 1-2, 6-11; see also John W. Herrick, Rocket Encyclopedia, pp. 502-507.
32. Ibid.
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34. Special Report, "300,000 Pound Rocket Static Test Stand," p. 1.
35. White Sands History, pp. 25-26.

36. Ibid.
37. White Sands Missile Range, Fact Sheet, "White Sands Missile Range at a Glance."
38. Ibid.
39. White Sands History, pp. 120-124; field inventory.
40. Ibid. pp. 22-24.
41. Ibid.
42. Installation Environmental Impact Assessment, pp. 16-25 and Real Property Inventory.
43. White Sands Missile Range, Fact Sheet, "Missile Park."
44. Armament Division 6585th Test Group Test Track Division, The Holloman Track, pp. 1-2; see also Herrick, pp. 419-420.
45. Ibid. p. 5.
46. Ibid. pp. 5-6.
47. Field inventory.
48. Holloman Track, pp. 35-44.
49. Ibid. pp. 19-34.
50. Thomas G. Alexander, "Brief Histories of Three Federal Military Installations in Utah," Utah Historical Quarterly, pp. 132-137.
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52. White Sands Missile Range, Installation Environmental Impact Assessment, p. 30.
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Chapter 3

PRESERVATION RECOMMENDATIONS

BACKGROUND

Army Regulation 420-40 requires that an historic preservation plan be developed as an integral part of each installation's planning and long range maintenance and development scheduling.¹ The purpose of such a program is to:

- Preserve historic properties to reflect the Army's role in history and its continuing concern for the protection of the nation's heritage.
- Implement historic preservation projects as an integral part of the installation's maintenance and construction programs.
- Find adaptive uses for historic properties in order to maintain them as actively used facilities on the installation.
- Eliminate damage or destruction due to improper maintenance, repair, or use that may alter or destroy the significant elements of any property.
- Enhance the most historically significant areas of the installation through appropriate landscaping and conservation.

To meet these overall preservation objectives, the general preservation recommendations set forth below have been developed:

Category I Historic Properties

All Category I historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

- a) Each Category I historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category I historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).
- b) An individual preservation plan should be developed and put into effect for each Category I historic property. This plan should delineate the appropriate restoration or preservation program to be carried out for the property. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above referenced ACHP regulation. Until the historic preservation plan is put into effect, Category I historic properties should be maintained in accordance with the recommended approaches of the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings² and in consultation with the State Historic Preservation Officer.

- c) Each Category I historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.³ When no adequate architectural drawings exist for a Category I historic property, it should be documented in accordance with Documentation Level I of these standards. In cases where standard measured drawings are unable to record significant features of a property or technological process, interpretive drawings also should be prepared.

Category II Historic Properties

All Category II historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

- a) Each Category II historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category II historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

- b) An individual preservation plan should be developed and put into effect for each Category II historic property. This plan should delineate the appropriate preservation or rehabilitation program to be carried out for the property or for those parts of the property which contribute to its historical, architectural, or technological importance. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above referenced ACHP regulations. Until the historic preservation plan is put into effect, Category II historic properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings⁴ and in consultation with the State Historic Preservation Officer.
- c) Each Category II historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.⁵

Category III Historic Properties

The following preservation recommendations apply to Category III historic properties:

- a) Category III historic properties listed on or eligible for nomination to the National Register as part of a district or thematic group should be treated in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800). Such properties should not be demolished and their facades, or those parts of the property that contribute to the historical landscape, should be protected from major modifications. Preservation plans should be developed for groupings of Category III historic properties within a district or thematic group. The scope of these plans should be limited to those parts of each property that contribute to the district or group's importance. Until such plans are put into effect, these properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings⁶ and in consultation with the State Historic Preservation Officer.
- b) Category III historic properties not listed on or eligible for nomination to the National Register as part of a district or thematic group should receive routine maintenance. Such properties should not be demolished, and their facades, or those parts of the property that contribute to the historical landscape, should be protected from modification. If the properties are unoccupied, they should, as a minimum, be maintained in stable condition and prevented from deteriorating.

HABS/HAER Documentation Level IV has been completed for all Category III historic properties, and no additional documentation is required as long as they are not endangered. Category III historic properties that are endangered for operational or other reasons should be documented in accordance with HABS/HAER Documentation Level III, and submitted for inclusion in the HABS/HAER collections in the Library of Congress.⁷ Similar structures need only be documented once.

CATEGORY I HISTORIC PROPERTIES

Trinity Site

- Background and significance. Trinity Site, the location of the test explosion of the world's first atomic bomb, is a National Historic Landmark and is listed on the National Register of Historic Places. Existing properties at Trinity Site include: Ground Zero, the site of the detonation; Jumbo, the specially designed, but never used, giant plutonium containment vessel; the camera and instrumentation bunkers to the north, northwest, and west of Ground Zero used to record the test; the McDonald ranch house, where the active nuclear core components of the bomb were assembled; and the remains of Base Camp, the on-site test headquarters.

These properties are all closely associated with the Trinity test, an event of major importance to the 20th century and perhaps to the history of mankind. Because of this association, Ground Zero, Jumbo,

the camera and instrumentation bunkers, the McDonald ranch house, and the remaining structures at Base Camp are Category I historic properties.

- Condition and potential adverse impacts.

- 1) Ground Zero. The area around Ground Zero was covered with a greenish glaze of fused sand and dirt particles when scientists first visited the detonation site after the blast. A low wooden shelter was erected over a portion of the material, named "trinitite" by the project scientists, to preserve it intact. The remainder of the trinitite has been scattered, but the site is otherwise unaltered and is protected by two large concentric circles of cyclone fencing. The wooden shelter that covers the trinitite is in fair condition. There are no plans to further disturb or otherwise modify the site.
- 2) Jumbo. Jumbo was unaffected by the explosion, and attempts were later made to destroy the huge vessel. Its hemispherical ends were removed by explosives, but further attempts to demolish Jumbo failed, and it was later moved to its present location at the entrance to Ground Zero. There are no plans to alter or move this property.
- 3) Camera and instrumentation bunkers. The remaining bunkers at 600 yards northwest, 800 and 10,000 yards west, and 800, 1,000, and 10,000 yards north are intact, although several have suffered minor damage in the past, perhaps partially from the test itself. There are no plans to alter or otherwise disturb these properties.

- 4) George McDonald ranch house. The ranch house has deteriorated significantly since the Trinity test, although no serious structural damage was caused by the shock wave from the blast (some of the existing window, roof, and chimney damage, however, occurred at that time). Stabilization of the structure began in 1982 and a definitive plan to determine the level of preservation appropriate for the structure has been prepared.
- 5) Base Camp. All of the temporary buildings erected by the Army at Base Camp were dismantled after the test. The wood frame and adobe ranch houses and the wood shed that remain are in poor condition. The wooden water tank and two adjacent tank and windmill structures are highly deteriorated. Several concrete foundations from Trinity Camp (the floors of a generator shed, latrine, and garage) are intact. At present, there are no plans to disturb these properties.

- Preservation options.

- 1) The McDonald ranch house has been documented to HABS/HAER Documentation Level I. The following properties will be recorded to HABS/HAER Documentation Level II: Jumbo and the tower base at Ground Zero; the instrumentation bunkers at West 800, Northwest 600, and North 800 and 1000; the camera bunkers at North and West 10,000; and the remaining properties at the site of Base Camp. Interpretive drawings will be prepared showing the relationships of these properties and their function in the Trinity test.

- 2) An historic preservation plan should be developed and put into effect for each of the above properties. The plan should focus on the degree to which each property should be protected, stabilized, or otherwise preserved. The buildings at Base Camp should be excluded from the plan until current litigation over these properties is resolved.

Launch Complex 33 (Army Blockhouse and V-2 Gantry Crane)

- Background and significance. Launch Complex 33 is of exceptional historical significance because of its close association with the origins of the American rocket program. It test fired 67 V-2 rockets between 1946 and 1951, the first major rocket firings conducted in the United States. The V-2 was the first vehicle to carry scientific instruments into the upper atmosphere, thereby greatly expanding atmospheric research. As the first large rocket with a liquid propellant motor, the V-2 provided the technological base for the Saturn 5, the rocket that first launched American astronauts to the moon. The intercontinental ballistic missile systems that have revolutionized strategic warfare are also technologically based on the V-2.

Major structures at Launch Complex 33 are the Army blockhouse (Building 20814), built in 1945 as the first permanent structure at White Sands; a 365' x 372' concrete launch pad with water spillway and blast deflector; and the V-2 gantry crane (Building 20820), a 75' moveable steel tower with four work platforms for servicing the rocket in-place. (See Chapter 2, Early Development of White Sands, and Illustrations 30-34).

The complex is a Category I historic property because of its close association with the V-2 program, its high degree of physical integrity, and its status as the first major rocket launch facility in the United States. Although it is less than 50 years old, it meets the criteria for exceptional significance and should be nominated to the National Register of Historic Places. Its nomination should, however, in no way preclude continued mission-related work at the launch complex site.

- Condition and potential adverse impacts. Launch Complex 33 is in good condition. The blockhouse is still in use and, except for minor changes, remains much the same as when built in 1945. The V-2 gantry crane is virtually intact and was cleaned and painted in 1982. The launch pad is also highly intact.
- Preservation options. Refer to the general recommendations for Category I historic properties at the beginning of this chapter.

CATEGORY II HISTORIC PROPERTIES

Holloman Test Track

- Background and significance. The Holloman Test Track, located in the Holloman Air Force Supplemental Area adjacent to White Sands Missile Range, is a high speed ground test facility used to simulate flight trajectories under closely controlled and rigorously monitored conditions. Test payloads are moved along a straight line path by means of rocket sleds that operate on a set of heavy duty continuously welded crane

rails 50,788 feet in length. Routinely capable of handling rocket sleds at velocities of 7,000 feet per second (Mach 6), it is the longest, most precisely aligned, and most completely instrumented facility of its kind. The original track was built in 1950 and was expanded to its present length in 1972. Support facilities include two rain simulation facilities, an ejection test site, a blast test site, an impact test site, four block-houses, a telemetry ground station (the Midway building) and amplifier building, a track control facility, and storage, maintenance, and shop facilities. The track remains fully operational today, and there are no plans to discontinue its active use. (See Chapter 2, Holloman Air Force Base Supplemental Area, and Illustrations 45-49.)

The test track is a Category II historic property because it is an important and highly unique work of engineering design. The property does not meet the exceptional significance criteria of the National Register for properties less than 50 years old because it is not yet truly historic nor can it be termed exceptionally important to any major aviation or space program.

- Condition and potential adverse impacts. The Holloman Test Track is an actively used facility and is maintained as such. Changes are made to the track and its supporting facilities as operational needs require. There are no plans to discontinue its use.
- Preservation options. Because the test track is an active facility and must respond to changing operational needs, the general preservation recommendations for Category II historic properties should not apply at

this time. The oldest part of the track will be 50 years old in the year 2000. Its historical significance should be reevaluated at this time, or earlier if the facility is to be altered significantly or deactivated.

100,000 Pound Static Test Stand

- Background and significance. The 100,000 (100K) Pound Static Test Stand, constructed early in 1946, was used until 1949 for testing V-2 rocket motors. An initial test took place in March, 1946, and subsequent tests led to later aerial firings of the V-2. The 100K facility could test liquid propellant propulsion units with a maximum capacity of 100,000 pounds of thrust. It was later modified for testing the Corporal missile, but has since been partially dismantled. (See Chapter 2, Early Development at White Sands, and Illustrations 37 and 38.)

The 100K Static Test Stand is a Category II historic property because of its association with the American V-2 rocket program. The facility does not meet the exceptional significance criteria of the National Register for properties less than 50 years old.

- Condition and potential adverse impacts. The 100K Static Test Stand is now abandoned. Its blockhouse and concrete flame pit are still intact, but its steel tower has been dismantled and its instruments removed. The facility is deteriorating slowly with age. There are no current plans to alter or demolish this property.
- Preservation options. Refer to the general preservation recommendations for Category II historic properties at the beginning of this chapter.

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500,000 Pound Static Test Stand

- Background and significance. The 500,000 (500K) Pound Static Test Stand was constructed between 1948 and 1950 for testing liquid propellant rocket motors for extended firings with up to 500,000 pounds of thrust. In 1950 and 1951 it was used for a series of long duration tests of V-2 rocket motors. It was modified in 1951 for testing Redstone power plants, and later Nike-Ajax and Nike-Hercules rocket motors. The facility is no longer used. (See Chapter 2, Early Development at White Sands, and Illustrations 39 and 40.)

The 500K Static Test Stand is a Category II historic property because of its direct association with the American V-2 and other early rocket programs at White Sands. It does not meet the exceptional significance criteria of the National Register for properties under 50 years old.

- Condition and potential adverse impacts. The 500K facility has been abandoned for some time and is deteriorating slowly with age. Although the basic structure is intact, all instrumentation and the fuel storage tanks have been removed. Its concrete observation bunker, located just west of the test stand, remains in good condition.
- Preservation options. Refer to the general preservation recommendations for Category II historic properties at the beginning of this chapter.

CATEGORY III HISTORIC PROPERTIES

V-2 Assembly Building (Building 1538)

- Background and significance. Building 1538, a huge metal quonset hut located in the middle of the main post area, was erected in 1945 to repair and reconstruct captured V-2 rockets. All 67 V-2 rockets test fired at White Sands between 1946 and 1951 were assembled in this facility. It is the earliest existing building on the main post and is one of the two remaining World War II era buildings at the installation (the other is the Army blockhouse). The facility is no longer used for rocket assembly, but its exterior appearance has changed little since 1945. (See Chapter 2, Background and Early Development at White Sands, and Illustrations 30 and 52.) The V-2 assembly building, although simply a standard metal quonset hut, is a Category III historic property because of its historical association with the V-2 rocket program.
- Condition and potential adverse impacts. The facility is maintained in good condition and is virtually intact. There are no current plans to alter or demolish this property.
- Preservation options. Refer to the general preservation recommendations for Category III historic properties at the beginning of this chapter.

Launch Complex 35 (Navy Blockhouse, Launch Towers, and U.S.S. Desert Ship)

- Background and significance. The Naval Ordnance Missile Test Facility at White Sands began the development of rocket firing facilities at

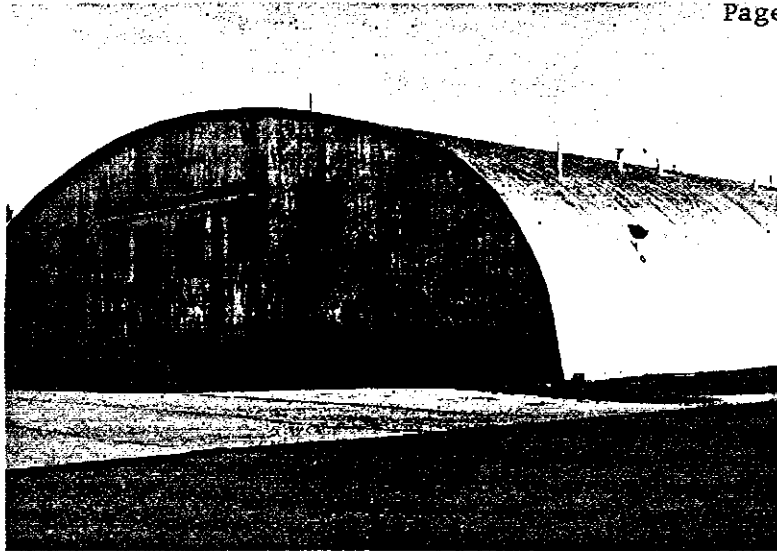


ILLUSTRATION 52 V-2 assembly building. Building 1538 was built in 1945 to assemble V-2 rocket parts captured in Germany for test firing at White Sands. It remains intact today in the center of the main post area (see also Illustration 29). Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.



ILLUSTRATION 53 Grave of Eugene Manlove Rhodes. Rhodes (1869-1934) was a prominent writer of western novels in the early part of this century. He is buried near his childhood home at the western end of Rhodes Canyon. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

what is now Launch Complex 35 in 1946, when it constructed a launch pad and two steel towers (Buildings 23230 and 23231). A reinforced concrete blockhouse, similar to the Army's, but smaller, was completed in 1947. In 1953, the Navy built the U.S.S. Desert Ship facility (Building 23270), a large concrete structure used as a control and radar building with instrumentation capable of simulating sea-like conditions for various missile tests. The blockhouse and Desert Ship are still in active use by the Navy. (See Chapter 2, Early Development at White Sands, and Illustration 36.) Launch Complex 35 is a Category III historic property because of its association with early Navy testing programs for the Aerobee, Viking, Lark, Talos, Terrier booster, and Loon missiles. The complex is the second oldest launch facility at White Sands and is highly intact.

- Condition and potential adverse impacts. Launch Complex 35 is maintained in good condition as an active Navy facility. There are no current plans to alter or demolish any of its constituent structures.
- Preservation options. Refer to the general preservation recommendations for Category III historic properties at the beginning of this chapter.

Estey City Mining Ruins

- Background and significance. The ruins of Estey City in the northeast portion of the missile range are the most complete remains of a single mining activity at White Sands. Built by the Dividend Mining and Milling Company, Estey City was an active copper mining complex early

in this century. The stone walls of the general store and post office are still identifiable, but little else remains. (See Chapter 2, Pre-Military Land Use, and Illustration 6.) The Estey City mining ruins are a Category III historic property because they are a good example of an important pre-military land use at White Sands.

- Condition and potential adverse impacts. The site is in a state of ruin, and will continue to slowly deteriorate with time. There are no current plans to disturb the site.
- Preservation options. The site should be left intact and undisturbed. Should further historic or archeological investigation prove the significance of the site, consideration should be given to stabilizing the ruins to prevent or retard further decay.

Eugene Manlove Rhodes Grave Site

- Background and significance. Eugene Manlove Rhodes, a nationally-known writer of western novels, poems, and short stories, was born in the Tularosa Basin in 1869. During his lifetime he published over 100 stories and fourteen novels, including Paso Por Aqui, which was later made into the motion picture "Four Faces West." Rhodes died in 1934 and his body was returned to Rhodes Canyon in the west central part of the missile range for burial. Under a 1951 New Mexico statute, New Mexico State University was named the custodian of the grave, a small fenced-in area with a simple stone grave marker and plaque.

(See Chapter 2, Pre-Military Land Use, and Illustration 53.) The grave site is a Category III historic property because of its historical association with this well-known writer.

- Condition and potential adverse impacts. The grave marker and plaque are intact, although the fence surrounding the site may need minor repair. There are no current plans to disturb this site.
- Preservation options. Refer to the general preservation recommendations for Category III historic properties at the beginning of this chapter.

Hardin Ranch

- Background and significance. The Hardin Ranch, located at the western end of Rhodes Canyon, is the only former ranch on the missile range that has not been abandoned. White Sands range inspectors maintain the ranch house, outbuildings, and corral as an up-range headquarters. The ranch house itself is a plain stone structure, less architecturally interesting than many on the range, but taken as a whole the ranch complex is representative of the many ranches once active at White Sands. (See Chapter 2, Pre-Military Land Use, and Illustration 54.) The Hardin Ranch is a Category III historic property because it is a good example of a highly intact ranch complex from an important historic era.
- Condition and potential adverse impacts. Hardin Ranch is maintained in good condition. There are no current plans to alter or demolish any of the properties at the ranch.

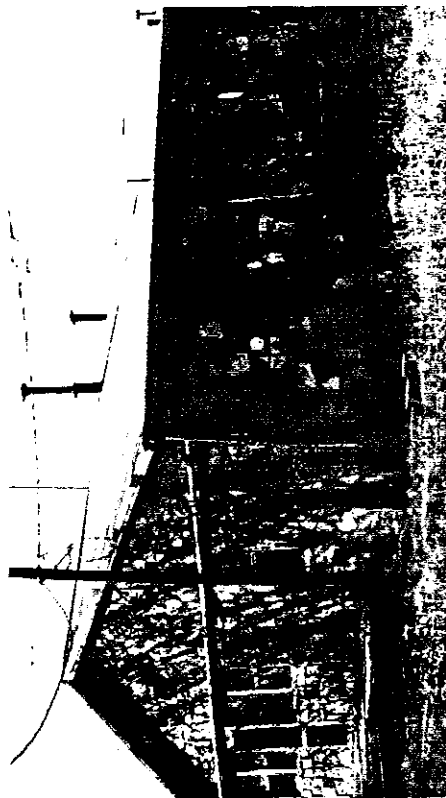
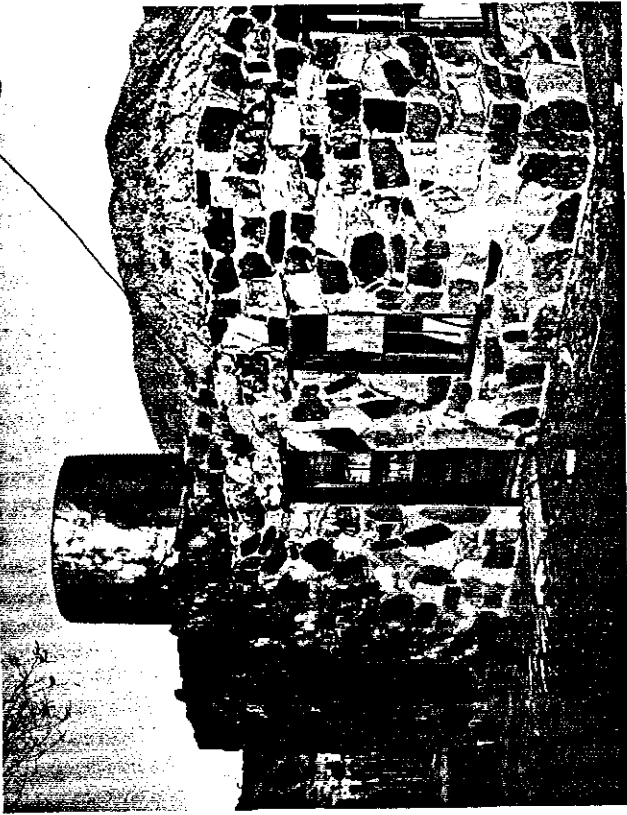


ILLUSTRATION 54 Hardin Ranch. Located at the western end of Rhodes Canyon, the Hardin Ranch is the only former ranch at White Sands that has not been abandoned. It is currently used to quarter range inspectors when they are located up-range. The ranch is fairly typical of those that were once active in the area, and most of its facilities, including the ranch house (above left), corrals (top left), outbuildings (top right), and windmill (right), are still in use. Source: Field inventory photograph, 1983, David G. Buchanan, Building Technology, Inc.

- Preservation options. Refer to the general preservation recommendations for Category III historic properties at the beginning of this chapter.

Propulsion Unit Calibration Stand Blockhouse

- Background and significance. The Propulsion Unit Calibration Stand blockhouse (Building 1592) was constructed in July 1946, apparently under the direction of Werner Von Braun. It was used as a protective control house for testing V-2 propulsion units on a nearby calibration stand. No controls or instrumentation remain in the blockhouse, and the calibration stand has since been dismantled. The blockhouse is a Category III historic property because of its close association with early V-2 rocket testing at White Sands (see Chapter 2, Early Development at White Sands, and Illustration 55).
- Condition and potential adverse impacts. The blockhouse is maintained in adequate condition as a storage building and there are no current plans to alter or demolish this property.
- Preservation options. Refer to the general preservation recommendations for Category III historic properties at the beginning of this chapter.

NOTES

1. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).
2. National Park Service, Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings, 1983 (Washington, D.C.: Preservation Assistance Division, National Park Service, 1983).

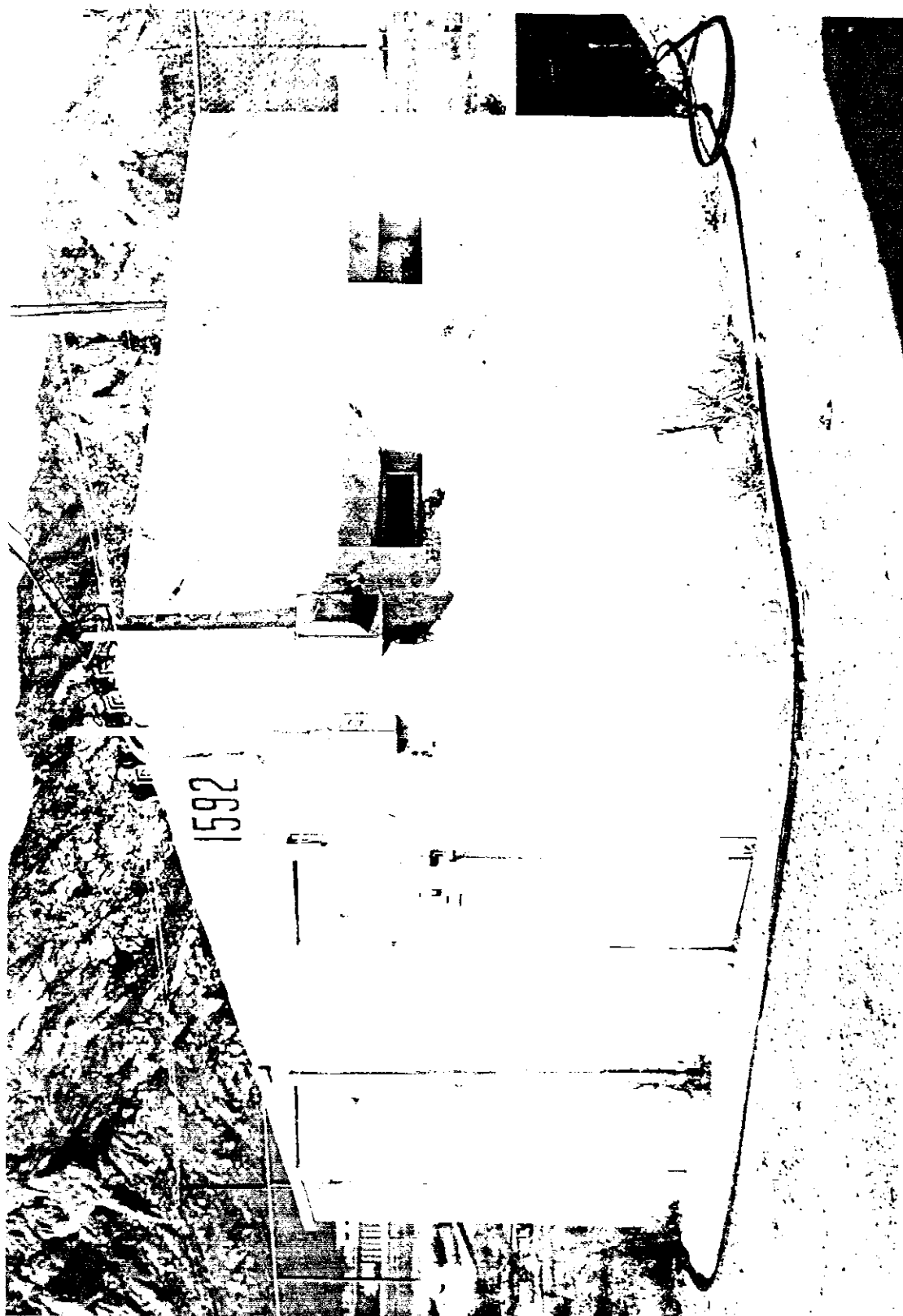


Illustration 55 Propulsion Unit Calibration Stand Blockhouse. This structure was built in July 1946 adjacent to a calibration stand that has been since removed. The stand was used to test V-2 propulsion units. (Source: Harry Butowski, National Park Service, 1984)

3. National Park Service, "Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines," Federal Register, Part IV, 28 September 1983, pp. 44730-44734.
4. National Park Service, Secretary of the Interior's Standards.
5. National Park Service, "Archeology and Historic Preservation."
6. National Park Service, Secretary of the Interior's Standards.
7. National Park Service, "Archeology and Historic Preservation."

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